White River Allocation

BULL SHOALS DAM TO THE MISSISSIPPI RIVER

<u>TECHNICAL ANALYSIS</u>

ARKANSAS SOIL & WATER
CONSERVATION COMMISSION

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INTRODUCTION

PLAN OBJECTIVES

The intent of this document is to provide guidance to water resource managers and users for utilization of the White River during times of "shortage", as defined by the Arkansas Soil and Water Conservation Commission. Allocation should follow a logical planning process and address the following questions as related to White River water use:

- What is an allocation plan? (page 1)
- What legislative authority(s) allows an allocation plan to be developed and who develops the procedures for the plan? (page 2)
- What considerations should be utilized in developing an allocation plan? (page 2)
- What happens when a "shortage condition" occurs? (pages 2, 8)
- Are there priorities between different types of water uses? (page 3)
- What types of water uses are exempted from allocation? (page 8)
- What are the existing instream resources and needs on the White River? (page 28)
- How do seasonal river flows affect the allocation plan? (pages 48, 83)
- What water level or White River flow constitutes a "shortage condition"? (page 49)
- How will an allocation plan affect riparian and Non-riparian diversions? (pages 83-93)
- When do allocation restrictions and all withdrawals from the White River stop? (pages 83-93)
- How long is an allocation plan valid? (page 94)
- What are potential enforcement penalties associated with allocation plan non-compliance? (Page 95)

Allocation procedures and plans should address "low-flow" conditions to provide minimum levels of protection for river and lake system resources. An allocation plan should formulate recommendations incorporating ecosystem management strategies whenever applicable, and will include available information that relates to long-term sustainability of natural and economic-based resources.

COMMISSION AUTHORITY

Arkansas, like most eastern states, has adopted a riparian system of water rights. Under a riparian system, water rights are attached to lands bordering a natural stream or lake. In this case, the most important of these rights is the right to make use of the flow of a stream. In the early years, the courts handled disputes for water rights. By 1953, the Arkansas Supreme Court held that under the riparian doctrine, no proprietor had priority in the use of another's rights [1]. By 1955, the Arkansas Supreme Court had accepted the reasonable use theory of riparian rights[2]. Today's water law has its basis in the reasonable use theory.

In 1957, the Arkansas General Assembly enacted Act 81[3]. This act empowered the Water Conservation Commission, which later became the Arkansas Soil & Water Conservation Commission[4] (Commission), with the authority to allocate surface water in times of shortage. This authority remained significantly unchanged until the passage of Act 1051[5] in 1985. Under Act 1051, the Commission was given the authority to "establish minimum stream flows"[6]. In 1989, this authority was further expanded to require the Commission to "establish and enforce minimum stream flows for the protection of in-stream water needs"[7]. To augment the applicable laws, the Commission adopted administrative rules and regulations [8]. These regulations supplement the State's water laws.

To institute a water allocation plan the Commission must find that there is or will likely be a shortage [9] and there is not sufficient water in a stream [10] to meet all beneficial uses. Beneficial uses include municipal domestic, industrial and agricultural, aquifer recharge, water quality maintenance, fish and wildlife, interstate compacts, and navigation. If the Commission determines that a shortage exists, it can develop an allocation plan to be used in times of shortage[11].

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[1] Thomas v. laCotts, 222 Ark. 171, 257 S.W.2d 936 (1953).
[2] Harris v. Brooks, 225 Ark. 436, 283 S.W.2d 129 (1955) Also see, Scott v. Slaughter, 237 Ark. 394, 373 S.W.2d 129 (1963)
[3] 1957 Ark. Acts 81, codified in Ark. Code of Annotated, 15-22-201 through 220.
[4] 1963 Ark. Acts 14, codified in Ark. Code of Annotated, 15-20-201 through 208.
[5] 1985 Ark. Acts 1051, codified in Ark. Code of Annotated, 15-22-301 through 304.
[6] Ark. Code of Annotated, 15-22-301(4).
[7] Ark. Code of Annotated, 15-22-222(a), codified from 1989 Ark. Acts 469 5(a).
[8] ASWCC Rules & Regulations -Title III, *Rules for Utilization of Surface Water*, all.
[9] ASWCC Rules & Regulations - *Rules for Utilization of Surface Water*, Section 307.1 and 301.3 II.
[10] The White River is considered a stream for allocation purposes, see Section 301.3 JJ under Title III.
[11] Allocation Procedures contained in ASWCC Rules Title III, Subtitles VII through XI.

<u>Reserved Water Rights</u>: The following uses and needs shall have a reserved water right, prior to allocations for other uses and needs:

A.) Domestic and Municipal Domestic: Public water systems historically dependent upon the affected stream shall receive a reserved water right for municipal domestic water use prior to allocations for other uses.

B.) Minimum Stream Flow: Minimum stream flow as established pursuant Title III Subtitle III of the Rules for the Utilization of Surface Water shall receive a reserved water right prior to allocations for other uses.

C.) Federal Water Rights: There may be some water the United States Government has a preemptive right to, that is superior to the rights of others.

<u>Priorities for Allocation</u>: All allocations shall give reasonable preference first to sustaining life, then to maintaining health, and finally to increasing wealth. The allocations shall reserve the water required for domestic and municipal domestic use, federal water rights and for minimum stream flow and shall then give preference in the following order for water uses and for types of water diversions:

1. Priority of Water Use.
   a) Agriculture.
   b) Industry.
   c) Hydropower.
   d) Recreation.
2. Priority of Water Diversions.
   a) Riparian.
   b) Non-riparian intrabasin transfer.
   c) Non-riparian interbasin transfer.
   d) Out of state transfer.

Any riparian landowner that has properly registered a water diversion with the Commission in compliance with the Arkansas Code Annotated §15-22 215 and the rules of the Commission shall be granted an allocation of water.

Any riparian landowner that has not previously diverted water (or timely registered any previous water diversions with the Commission) may not be granted any allocation of water during times of shortage above that required for domestic use.

Non-riparian uses (including intrabasin, interbasin, and interstate transfers previously authorized by the Commission) which are beneficial and do not interfere with the uses detailed in the "Reserved Water Rights" section (or those found in the "Priorities for Allocation" section) may be granted an allocation.

DEFINITIONS

The following definitions shall apply to all parts of these rules.

- Affected Persons: Persons, other than the petitioner, whose water rights could reasonably be affected by permitting or allocating water under these rules.
- Allocation: The assignment of an allowance of a specific quantity of water that may be removed from any given stream and transported away from the stream for a designated beneficial use during times of shortage.
- Allocation Level: The level of a stream at which a water shortage occurs and the allocation process begins.
- Arkansas Water Plan: The comprehensive program for the orderly development and management of the State's water and related land resources developed by the Commission.
- Average Annual Yield: The average of the quantity of water passing through a watershed each year during the applicable period of record. In the event that adequate records are not available for an arithmetic average, a suitable estimate may be computed.
- Basin of Origin: The water basin from which an interbasin transfer of surface water is diverted.
- Beneficial Use: The instream and offstream uses of water in such quantity as is economical and efficient and reasonable, not wasteful, and compatible with the public interest.
- Commission: The Arkansas Soil and Water Conservation Commission as defined in Ark. Code Ann §15-20-201 *et seq.*
- Commissioner: A member of the Arkansas Soil and Water Conservation Commission, as defined in Ark. Code Ann §15-20-201 *et seq.*
- Conservation District: A district created under the Conservation District Law, Title 14, and Chapter 125 of the Arkansas code of 1987 Annotated.
- Conservation Plan: A plan as evidenced by written document for implementation of economical and technically feasible practices for improving the efficiency of water use. At a minimum, the Plan shall address the following concerns where applicable: leakage and loss control, water reuse, promotion of water saving devices, drought emergency plans, irrigation system efficiency and tailwater recovery.

- Critical Surface Water Area: An area where current water use, projected water use, or water quality degradation has or will cause a shortage of useful water in a relatively short period of time, and for a sufficient length of time to result in prolonged economic or environmental problems.

- Diffused Surface Water: Water occurring naturally on the surface of the ground other than in natural or altered stream channels, lakes or ponds.

- Director: The Executive Director of the Arkansas Soil and Water Conservation Commission, as defined in Ark. Code Ann §15-20-201 *et seq.*

- District: Conservation district or regional water district.

- Diverter: Any person that removes water from any source and makes any use thereof.

- Domestic Use: The use of water for ordinary household purposes including human consumption, washing, and the watering of home gardens for consumption by the household.

- Excess Surface Water: Twenty-five per cent of the average annual yield from any watershed above that amount, as determined by the Commission, required to satisfy all of the following that are applicable:

  A. Riparian and non-riparian usage reported for the 1989 water year as provided for in Title III Subtitle II.

  B. The water needs of the federal water projects as they existed on June 28, 1985.

  C. The firm yield of all affected reservoirs existing on June 28, 1985.

  D. Maintenance of minimum stream flows for the following streams (these constitute an initial phase - other streams will be added as needs arise and resources are made available):

     1. Arkansas River from Oklahoma boundary to mouth.

     2. Black River from Missouri boundary to mouth.

     3. Eleven Point River from Missouri boundary to mouth.

     4. Ouachita River from Lake Catherine to Louisiana boundary.

     5. Red River from Texas boundary to Louisiana boundary.

6. St. Francis River from Marked Tree to mouth.

7. Spring River from Missouri boundary to mouth.

8. White River below Bull Shoals Lake to mouth.

E. Future water needs of the watershed as projected in the Arkansas Water Plan.

- Firm Yield: The maximum amount of water a reservoir will yield based upon the driest period of record, recognizing that a more severe drought than any on record may occur.

- Interbasin Transfer: The transfer of water between basins, except transfers across a basin boundary by a riparian, as described in Title III Subtitle V.

- Intermittent Stream: Those streams whose flows are seasonal in nature and do not flow continuously. (The intent of the Commission is to define the intermittent streams by a statistical method once sufficient stream flow data is available at the conclusion of the "Low Flow Characteristics of Arkansas Streams" study).

- Intrabasin Transfer: The transfer of water within a basin, as described in Title III Subtitle V.

- Minimum Stream Flow: The quantity of water required to meet the largest of the following in-stream flow needs as determined on a case by case basis:

  A. Aquifer recharge.

  B. Fish and wildlife.

  C. Interstate compacts.

  D. Navigation.

  E. Water quality.

- Municipal Domestic Use: The use of water for ordinary household purposes including human consumption, laundry, bathroom facilities, fire protection, and the watering of home gardens, which is distributed by a central distribution system.

- Navigable Stream: Any watercourse that the federal government or the laws of the State of Arkansas declare to be navigable or that can be found to be navigable in fact.

- Non-Consumptive Use: The withdrawal of water for use in a manner that results in an approximately equal volume of water being returned to the same surface water body from which it was withdrawn.

- Non-Riparian Owner: The owner of land that is not contiguous to surface water and who has not obtained access to surface water by lease, easement or other method prior to March 1, 1990.

- Non-Riparian Water Right: A permit issued under these regulations to use excess surface water.

- Permittee: The holder of a water right.

- Person: Any natural person, partnership, firm, association, cooperative, municipality, county, public or private corporation, and any federal, state or local government agency.

- Petitioner: A person, other than the Commission, who seeks allocation of water through the Commission's Rules.

- Regional Water District: A district created under the Regional Water Distribution Act, Title 14, and Chapter 116 of the Arkansas Code of 1987 Annotated.

- Riparian Landowner: The holder in fee, leasehold, easement or other acquired access of any land that is contiguous to surface water in the State of Arkansas. Provided, however, that the leasehold, easement or other acquired access must have been acquired before March 1, 1990. Flowage easements will not invalidate the riparian rights of the landowner.

- Riparian Water Rights: Rights to water that accrue to riparian landowners.

- Shortage: When there is not sufficient water in a stream to meet all beneficial uses.

- Stream: A watercourse - including springs, lakes, or marshes from which flow originates or through which it passes - where the flow is in a reasonably defined channel; but excluding a depression, swale, or gully through which diffused surface water flows.

- Surface Water: Water occurring on the surface of the ground in lakes, ponds and in natural or channeled streams.

- Tailwater Recovery System: A system for recovery and reuse of water by the same diverter.

- Water Year: A twelve-month period beginning on October 1 of each year.

- Watershed: The drainage area of a stream and its tributaries.

EXEMPTIONS

Whenever a shortage of water in any stream exists, the Commission may (on its own initiative, or on the petition of any other person claiming to be affected by such shortage of water, after notice and hearing) allocate available water among the affected uses. This must be accomplished in such a manner that each affected user may obtain an equitable portion of the available water[12].

The following water is usable without allocation procedures:

A.) Diversions by any persons of less then 325,851 gallons (1-acre-foot) of water in any water year.

B.) Water captured by tailwater recovery systems.

C.) Water diverted from lakes, ponds, reservoirs, or springs in the exclusive ownership of one person.

D.) Water previously captured whether transmitted by ditch, channel or pipe.

E.) Water diverted from intermittent streams.

F.) Diffused surface water.

G.) Water captured by instream pit reservoirs, dams constructed pursuant to a lawful permit, or low water weirs and water stored in a federal impoundment.

H.) Non-consumptive usage.

CORPS "DROUGHT CONTINGENCY PLAN"

The U.S. Army Corps of Engineers has in place a Drought Contingency Plan[13] (Plan) for the White River Basin. The purpose of the Plan is "to provide a basic reference for water management decisions and coordination (at Upper White River reservoirs) in response to drought-induced water shortages. The Plan identifies the foreseeable operational and physical problems that would result in meeting the user's needs as the stored water is depleted . . . the Plan includes procedures and requirements for providing emergency water supply sources and releases." The primary uses of the (five) lakes projects as

[12] ASWCC Rules and Regulations-Title III, *Rules for the Utilization of Surface Water*, Sections 307.1 and 307.2.

[13] USACE Master Manual for Reservoir Regulation, White River Basin, Arkansas and Missouri, Appendix (1989).

authorized are for flood control, hydropower production, and water supply. Secondary uses of the stored and released water are water supply, recreation, fish and wildlife, irrigation, and navigation. Primary authorized uses of the Projects are prioritized during "shortage" conditions. Secondary uses are also mentioned in the Plan. Requests for stored water can be made to the Corps of Engineers. The Corps is then authorized to respond, and may release up to fifty acre-feet of water for emergency withdrawals[14].

The Plan defines a drought as a "climatically induced water shortage" and uses the National Weather Service's Palmer Drought Severity Index (PDSI) as one means of categorizing the severity of a drought. The plan identifies a drought as one of the following: mild, moderate, severe, or extreme. Three droughts have occurred in the basin that can be categorized as severe or extreme: 1952-1956, 1962-1964, and 1980-1981. Once a drought has been declared, the Corps will act as an interface with federal and state agencies to fulfill needs in accordance with the Plan.

The Drought Contingency Plan is one part of the overall operational plan for the White River Lake projects. The Corps formed an Ad hoc Committee comprised of other federal agencies, state organizations, and local interest groups that assisted in amending the day-to-day operation (Master Manual) for the Upper White River Projects. Recommendations were provided, and the Corps has completed this effort.

[14] Flood Control Act of 1944, Section 6.

STREAM HYDROLOGY AND FLOW DATA

BASIN DESCRIPTION

The White River drainage basin (Figure 1) covers over 27,765 square miles, of which 11,684 square miles lie in Arkansas. The Arkansas State Water Plan separates the White River into the Upper White River Basin and the Lower White River as part of the Eastern Arkansas Basin. The White River originates in the Boston Mountains in northwest

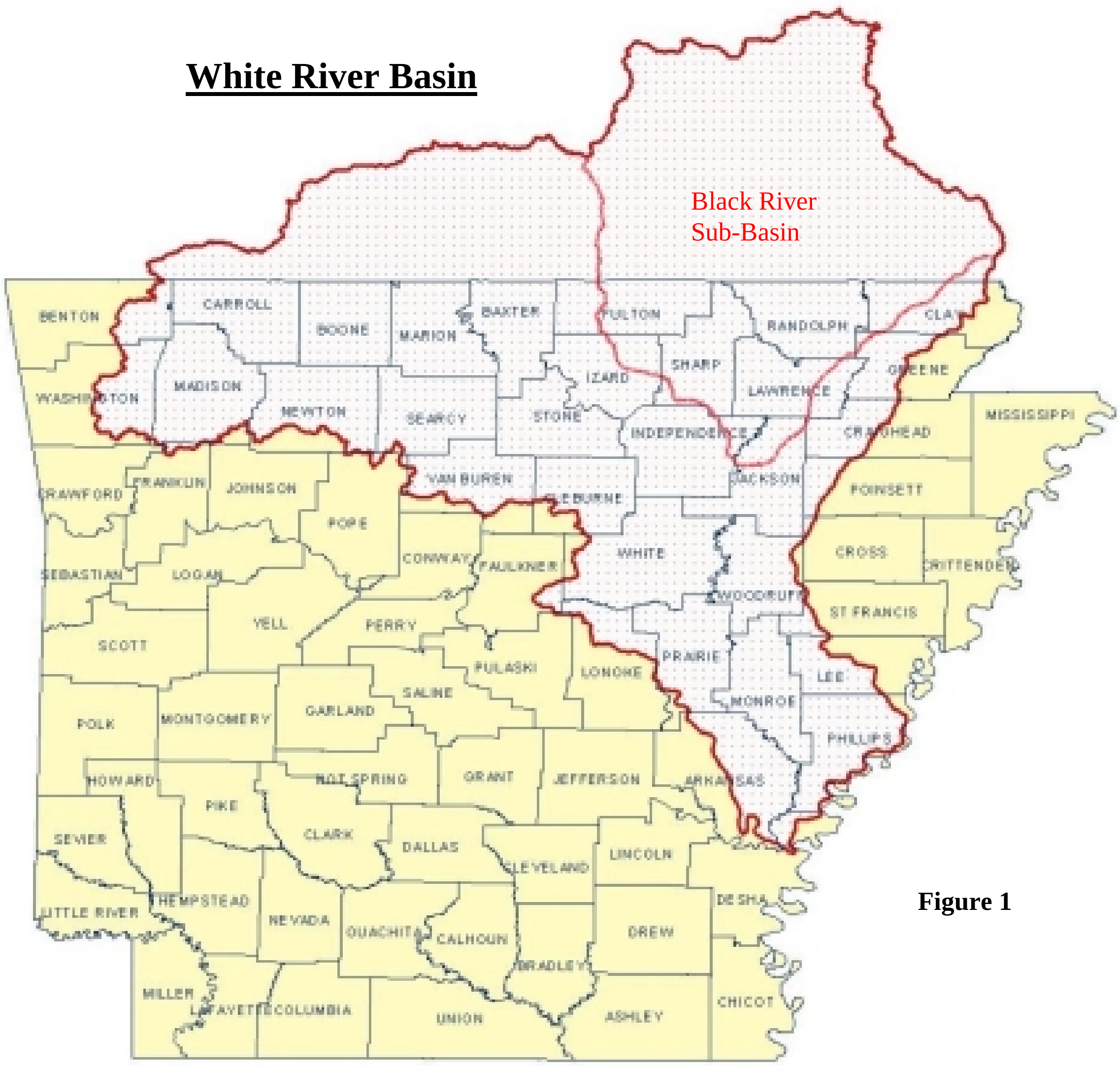


Figure 1

Arkansas and flows in a northerly direction to the Arkansas-Missouri state line. The White River then flows easterly for about 115 miles in southern Missouri, and then about 30 miles along either side of the state line before it crosses back into Arkansas. From that point, it flows in a southeasterly direction to its confluence with the Black River near Newport, Arkansas. The White River continues in a southerly direction to join the Mississippi River in the northeast corner of Desha County. The Black River has a drainage basin of 8,520 square miles in Arkansas and Missouri, with Clearwater Dam impounding 414 square miles and forming its headwater[12]. The Black River sub-basin accounts for nearly 30% of the total White River drainage area.

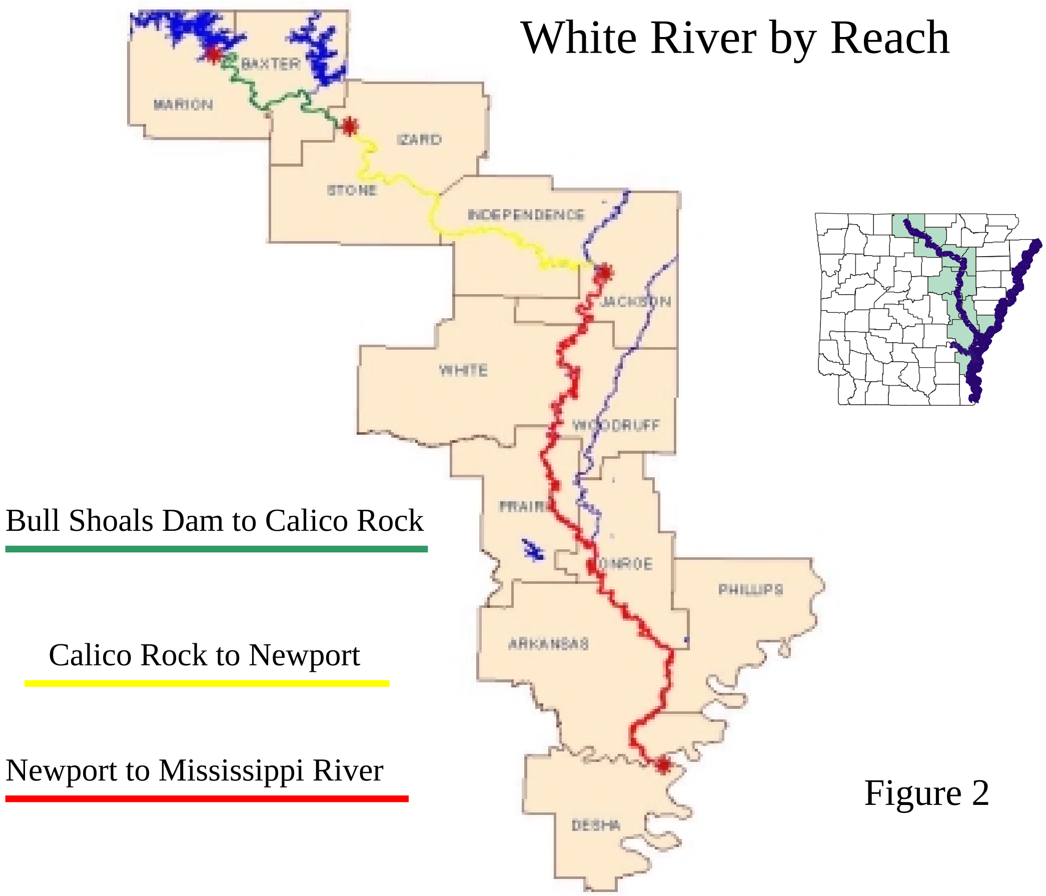


Figure 2

Stream flow of the lower White River is influenced by operation of the upper White River Projects (lakes and dams). These projects include Beaver, Taneycomo, Table Rock, and Bull Shoals Dams on the upper White River. Also included is Norfork Dam on the North Fork of the White River; Clearwater Dam on the Little Black River; and Greers Ferry Dam on the Little Red River. These projects control 48% of the White River's total drainage area. The remaining drainage contributions to the lower White River are dependent on annual precipitation patterns and climatic conditions.[13]

Figure 2 on page 11 shows the recommended White River reaches used in this analysis. In the mountainous portion of the White River below Bull Shoals Dam, cold water flows along a very crooked, narrow channel that has eroded through rock in numerous places. The streambed is composed of rocks, gravel and boulders in this reach. The character of the White River downstream from Batesville is a wide and meandering channel with flat slopes and banks formed of comparatively stable material. The White River in this reach is very crooked, and this is the transition zone from cold waters to warm. The White

[12] ASWCC, State Water Plan, Eastern Arkansas Basin
[13] Little Rock District, U.S. Army Corps of Engineers

River transports only a small amount of sediment in this reach. At Newport, near the mouth of the Black River, the White River is a twisting channel with banks and streambed composed of fine sands, silt, and clay. The water quality changes from that of a clear stream to a turbid river. The fall of the river averages about 0.4 ft per mile in the lower valley. The channel ranges from 200 to 400 feet wide between banks, whose heights range from 20 to 25 feet in the upstream third of this reach. In the downstream two-thirds of the reach, channel width ranges from 400 to 800 feet, and bank heights range from 25 to 30 feet. Flow is sluggish in the lower reach because of these flat stream slopes.

STAGE DISCHARGE RELATIONSHIP

The Memphis District, U.S. Army Corps of Engineers (Corps of Engineers) conducted feasibility studies and produced a 1979 report entitled: *White River Navigation to Batesville, Arkansas ("1979 Report").* Analyses of alternatives to develop an "open-river" (no locks or dams) navigation project for the White River was based on the period of record of 1923-1967 for Newport, and 1923-1969 for Clarendon. Records at both stations were adjusted to emulate the effect of all upstream reservoir regulation. In the recommended plan, navigation potential was based on a 95% exceedence flow, which was considered the highest exceedence flow value that could be maintained in an "open-river" system.

The Corps of Engineers compiled additional stream flow statistics for the White River associated with the Eastern Arkansas Region Comprehensive Study[14]. The duration analyses indicate a lower 95% exceedence flow than previously cited in the "*1979 Report*". Streamflow data utilized in this report were actual observed discharges at Newport, Clarendon, Augusta, Georgetown, Des Arc, DeValls Bluff, and St. Charles for the available period of record and reflect regulation of the upper White River. The following tables (and those found in Appendix A) contain Corps of Engineers exceedence values for period of record flows at various White River stations, and predicted minimum river depths with the current authorized dredging and navigation project. This data does not represent observed streamflow requirements needed for any specified level of river commerce or navigation. Rather, this data represents historic White River gage observations and their relationship to current Corps of Engineers' operations and maintenance programs.

The Corps of Engineers has also completed the "*White River Navigation to Newport, Arkansas General Investigations*" report under authority of the Water Resources Development Act of 1996. This report indicates that a channel with a bottom width of 125 feet and a depth of nine feet from the Arkansas Post Canal to Newport is economically and environmentally feasible. The Corps is currently continuing the general reevaluation of the authorized White River project. The design of the channel has been

[14] Eastern Arkansas Region Comprehensive Study; Grand Prairie Region and Bayou Meto Basin, Arkansas Project; Grand Prairie Area Demonstration Project; General Reevaluation Report.

optimized, resulting in the need for a 125-foot bottom-width channel from Arkansas Post Canal to Newport, Arkansas. Micro-models have been developed for two reaches of the river and used to verify optimum design parameters, and environmental studies are ongoing. The Corps of Engineers is expected to complete this reevaluation as funding allows.

The Southwestern Power Administration and the White River Dissolved Oxygen Committee, consisting of various state and federal agencies, continue to meet regularly to address operation of the upper White River projects. Topics for the Committee's consideration have included generating schedules, dam and turbine modifications, minimum flow and oxygen levels, and the timing and temperature of releases necessary to maintain habitat and aesthetics downstream from the projects. This committee work will continue for the near future.

Mean Daily Discharges:

WHITE RIVER- NEWPORT, AR.
PERIOD OF RECORD 1965-1999

MONTH	DAILY DISCHARGE		MEAN DAILY DISCHARGE
	Maximum	Minimum	
January	99,200	4,180	28,189
February	130,000	6,030	30,473
March	193,000	6,220	34,128
April	229,000	5,110	38,983
May	118,000	5,490	31,991
June	59,500	5,870	19,665
July	31,500	5,560	16,273
August	30,400	4,590	13,790
September	42,500	4,070	11,849
October	52,500	3,150	11,652
November	13,000	3,210	17,496
December	289,000	4,120	28,843

Table 1. Daily maximum, minimum, and mean discharge by month for the Newport gage (flows are in cubic feet per second or cfs).

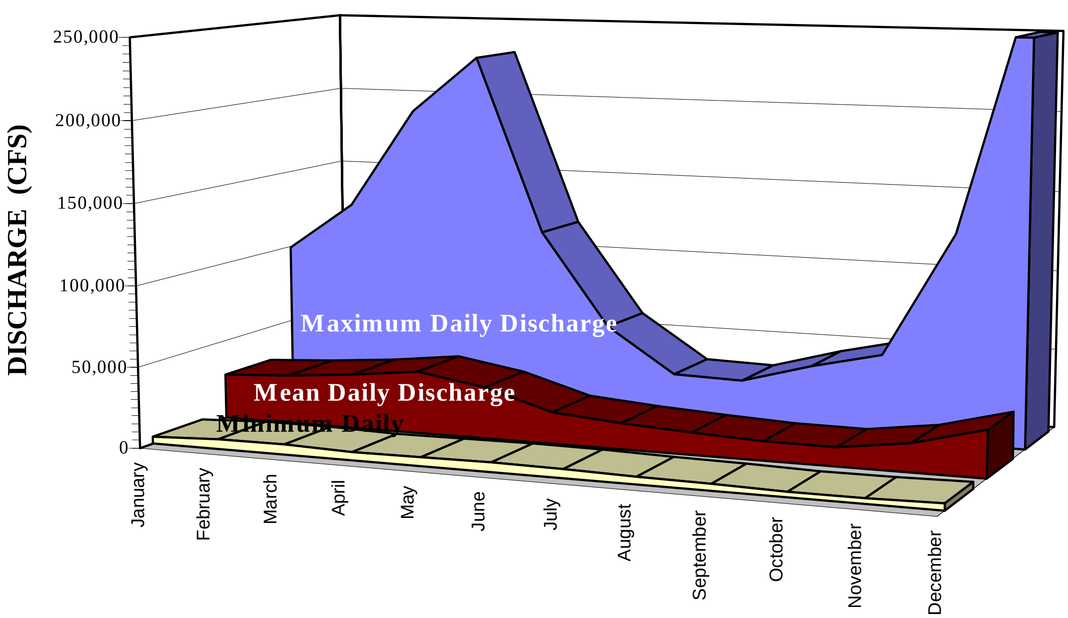


Figure 3. Graphical representation of daily minimum, mean, and maximum flows recorded at Newport from 1965-1999.

WHITE RIVER- CLARENDON, AR.
PERIOD OF RECORD 1963-1995

MONTH	DAILY DISCHARGE		MEAN DAILY DISCHARGE
	Maximum	Minimum	
January	132,400	5,200	39,575
February	149,400	5,600	41,427
March	133,066	8,500	45,291
April	188,000	7,700	50,413
May	190,000	7,010	47,059
June	78,900	8,100	26,908
July	45,100	8,200	19,758
August	34,000	6,629	16,707
September	34,000	5,377	14,236
October	54,300	4,200	13,640
November	70,438	4,237	18,733
December	177,700	5,582	35,698

Table 2. Daily maximum, minimum, and mean discharge by month for the Clarendon gage (flows are in cubic feet per second or cfs).

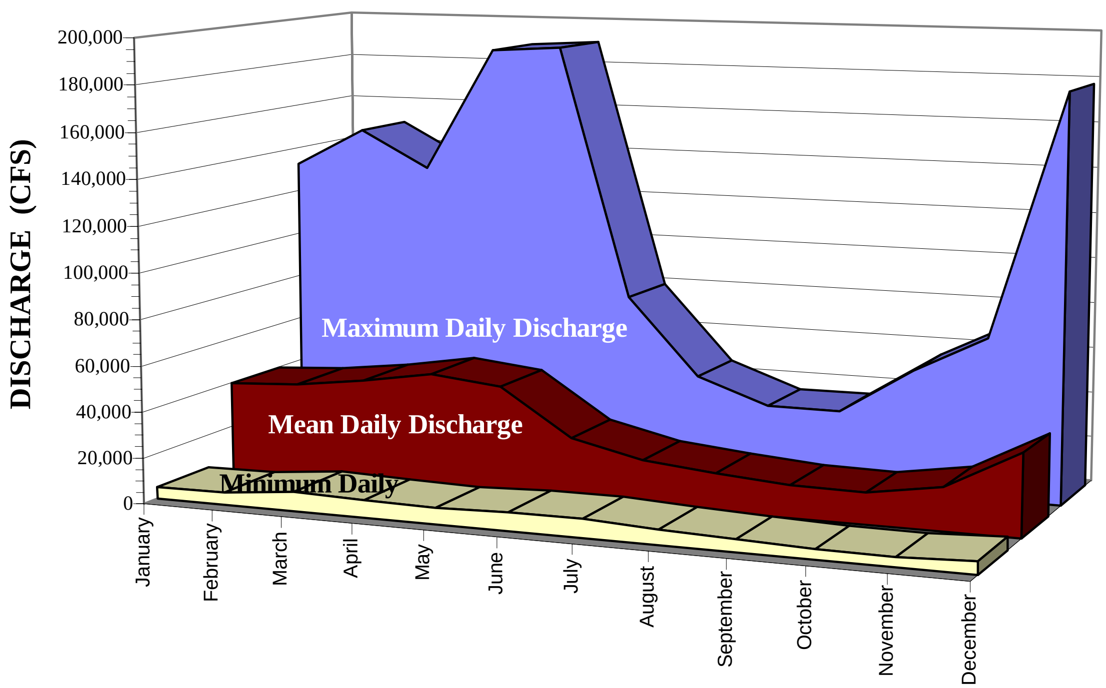


Figure 4. Graphical representation of daily minimum, mean, and maximum flows recorded at Clarendon from 1963-1995.

WHITE RIVER- CALICO ROCK, AR.
PERIOD OF RECORD 1963-1999

MONTH	DAILY DISCHARGE		MEAN DAILY DISCHARGE
	Maximum	Minimum	
January	78,100	656	11,490
February	79,000	656	12,879
March	75,600	713	14,799
April	59,700	914	14,775
May	96,300	1,130	11,666
June	38,900	1,110	9,363
July	21,900	1,340	9,717
August	24,800	1,100	8,459
September	41,600	866	6,330
October	40,400	500	5,973
November	64,400	596	7,329
December	87,300	622	11,446

Table 3. Daily maximum, minimum, and mean discharge by month for the Calico Rock gage (flows are in cubic feet per second or cfs).

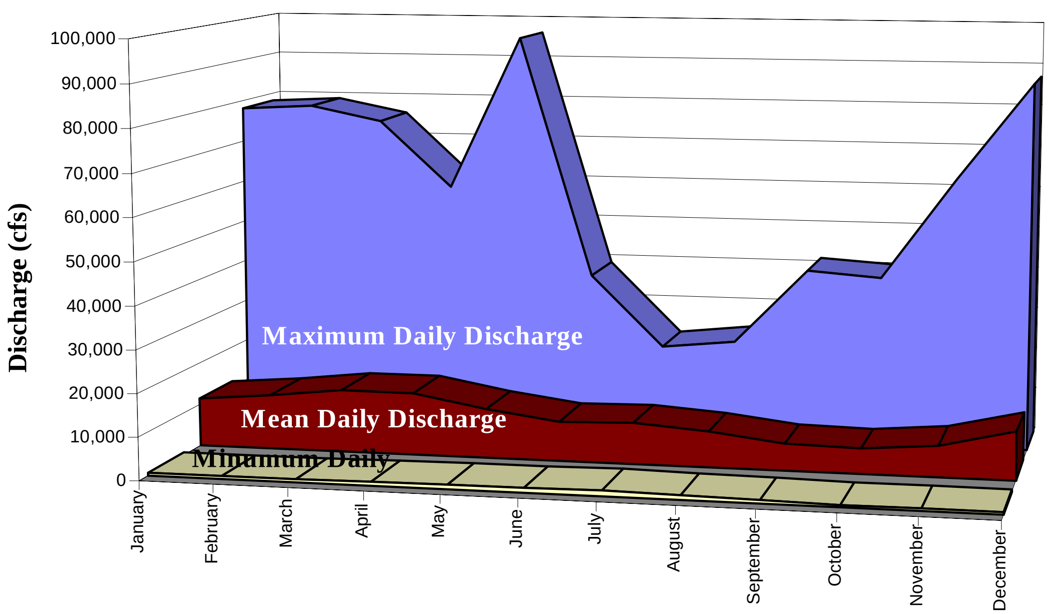


Figure 5. Graphical representation of daily minimum, mean, and maximum flows recorded at Calico Rock from 1963-1999.

Frequency Analysis:

White River at Newport, Arkansas HIGH DAILY MEAN VALUES - P.O.R. 1965-1992								
Return Period (years)	Duration (Days)							Return Period (years)
	1	7	15	30	60	120	183	
	Discharge, cfs							
100	344,000	199,000	142,000	113,000	96,600	88,400	72,300	**100**
50	284,000	178,000	131,000	106,000	89,200	79,700	65,500	**50**
20	216,000	151,000	116,000	94,100	78,600	68,000	56,300	**20**
10	171,000	128,000	103,000	84,000	69,600	58,700	49,000	**10**
5	130,000	105,000	87,000	72,100	59,400	48,900	41,200	**5**
2	77,500	68,200	60,300	51,400	42,100	33,600	28,800	**2**

Table 4 A. High flow frequencies.

White River at Newport, Arkansas LOW DAILY MEAN VALUES - P.O.R. 1965-1992								
Return Period (years)	Duration (Days)							Return Period (years)
	1	7	15	30	60	120	183	
	Discharge, cfs							
100	2,100	2,500	2,700	3,010	3,650	4,660	5,380	**100**
50	2,700	3,100	3,300	3,450	4,110	5,120	5,980	**50**
20	3,350	3,650	3,850	4,180	4,860	5,890	6,960	**20**
10	3,720	4,150	4,390	4,890	5,600	6,670	7,950	**10**
5	4,150	4,740	5,120	5,840	6,600	7,750	9,320	**5**
2	5,210	6,190	6,870	7,970	8,910	10,400	12,600	**2**

Table 4 B. Low flow frequencies*.

* Example: The 7Q10 low mean flow is 4,150 cfs. 7Q10 is defined statistically as the mean daily flow that occurs for seven concurrent days in a ten-year period.

White River at Newport, Arkansas HIGH DAILY MEAN VALUES - P.O.R. 1965-1992								
Return Period (years)	Duration (Days)							Return Period (years)
	1	7	15	30	60	120	183	
	Stage, ft							
100	*	31.7	30.1	28.9	28	27.4	25.8	**100**
50	*	31.1	29.7	28.6	27.5	26.6	24.8	**50**
20	32	30.4	29.1	27.9	26.5	25.2	23	**20**
10	30.9	29.6	28.4	27.1	25.4	23.5	21.2	**10**
5	29.7	28.5	27.3	25.7	23.7	21.1	18.4	**5**
2	26.4	25.2	23.9	21.8	18.7	15.4	13.3	**2**

Table 4 C. High flow stage frequencies.

White River at Newport, Arkansas LOW DAILY MEAN VALUES - P.O.R. 1965-1992								
Return Period (years)	Duration (Days)							Return Period (years)
	1	7	15	30	60	120	183	
	Stage, ft							
100	*	*	*	*	*	-0.4	0.2	**100**
50	*	*	*	*	-1	0	0.6	**50**
20	*	*	*	-0.9	-0.2	0.6	1.4	**20**
10	*	-0.9	-0.6	-0.2	0.4	1.2	2.2	**10**
5	-0.9	-0.4	0	0.6	1.2	2	3.1	**5**
2	0	0.8	1.4	2.2	2.8	3.9	5.2	**2**

Table 4 D. Low flow stage frequencies.

Note: Stages derived from USGS Rating Table
Gage Zero = 194.09 NGVD
* Not Available - USGS Rating Table extends from 4,025 cfs to 261,900 cfs

White River at Clarendon, Arkansas HIGH DAILY MEAN VALUES - P.O.R. 1965-1992								
Return Period (years)	Duration (Days)							Return Period (years)
	1	7	15	30	60	120	183	
	Discharge, cfs							
100	240,000	232,000	220,000	183,000	151,000	131,000	108,000	**100**
50	217,000	212,000	200,000	163,000	135,000	115,000	96,000	**50**
20	185,000	178,000	166,000	137,000	115,000	95,000	50,600	**20**
10	160,000	152,000	140,000	117,000	98,800	82,600	69,000	**10**
5	133,000	126,000	114,000	97,300	82,200	67,300	57,200	**5**
2	91,000	85,500	77,800	67,600	56,900	45,600	39,600	**2**

Table 5 A. High flow frequencies.

White River at Clarendon, Arkansas LOW DAILY MEAN VALUES - P.O.R. 1965-1992								
Return Period (years)	Duration (Days)							Return Period (years)
	1	7	15	30	60	120	183	
	Discharge, cfs							
100	3,160	3,430	3,850	4,140	4,880	6,560	7,290	**100**
50	3,560	3,850	4,280	4,660	5,440	7,090	8,030	**50**
20	4,200	4,550	4,990	5,520	6,360	7,960	9,250	**20**
10	4,840	5,240	5,680	6,350	7,250	8,840	10,500	**10**
5	5,700	6,170	6,620	7,460	8,440	10,100	12,100	**5**
2	7,680	8,310	8,820	9,940	11,200	13,000	16,100	**2**

Table 5 B. Low flow frequencies*****.

***** Example: The 7Q10 low mean flow is 5,240 cfs. 7Q10 is defined statistically as the daily mean flow that occurs for seven concurrent days in a ten-year period.

White River at Clarendon, Arkansas HIGH DAILY MEAN VALUES - P.O.R. 1965-1992								
Return Period (years)	**Duration (Days)**							**Return Period (years)**
	1	**7**	**15**	**30**	**60**	**120**	**183**	
	Stage, ft							
100	36.7	36.4	35.8	34.2	32.6	31.6	30.3	**100**
50	35.7	35.5	34.9	33.2	31.8	30.7	29.6	**50**
20	34.3	34	33.3	31.9	30.7	29.6	28.7	**20**
10	33	32.6	32.1	30.8	29.8	28.8	27.9	**10**
5	31.7	31.3	30.7	29.7	28.8	27.8	26.9	**5**
2	29.3	29	28.5	27.8	26.9	25.5	24.6	**2**

Table 5 C. High flow stage frequencies.

White River at Clarendon, Arkansas LOW DAILY MEAN VALUES - P.O.R. 1965-1992								
Return Period (years)	**Duration (Days)**							**Return Period (years)**
	1	**7**	**15**	**30**	**60**	**120**	**183**	
	Stage, ft							
100	5.5	5.8	6.2	6.5	7.2	8.6	9.1	**100**
50	5.9	6.2	6.6	7	7.6	9	9.7	**50**
20	6.5	6.9	7.3	7.7	8.4	9.6	10.5	**20**
10	7.1	7.5	7.9	8.4	9.1	10.3	11.4	**10**
5	7.9	8.2	8.6	9.3	10	11.2	12.5	**5**
2	9.4	9.9	10.3	11	11.9	13.1	15.1	**2**

Table 5 D. Low flow stage frequencies.

Note: Stages derived from USACE Rating Table
Gage Zero = 139.91 NGVD

Monthly Precipitation (NE Arkansas) Versus White River Flow at Clarendon

(1965-1995)

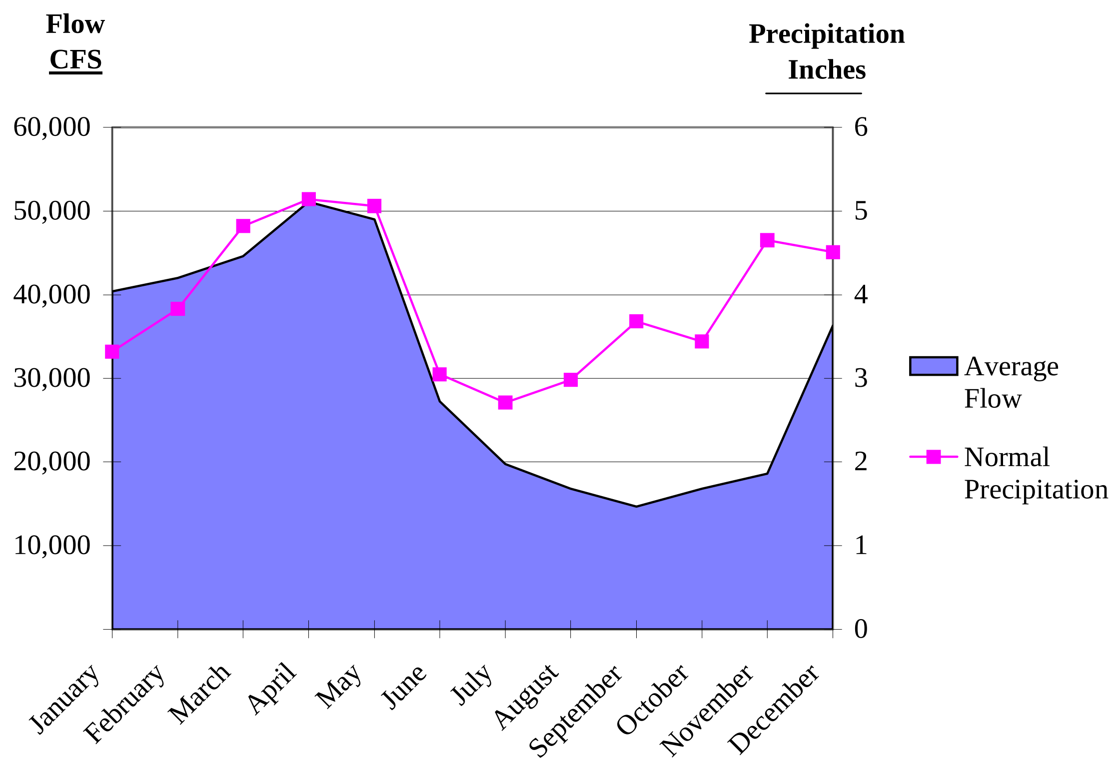


Figure 6. Monthly precipitation records were obtained for Northeastern Arkansas from the National Weather Service. Flow data at Clarendon represents average flow on the White River. Rainfall appears analogous to flow on the White River.

CURRENT & PROJECTED USE

RIPARIAN USE

Act 81 of 1957[16]requires all diverters of water from streams, lakes, or ponds to register their diversion of surface water by quantity, location, type of use, and name of user on an annual basis with the Commission. The Commission is required to furnish each registrant a Certificate of Registration. The Commission uses these registrations for the allocation of water and as a basis for determining the state's overall water use and water needs for inclusion in the Arkansas Water Plan.

Act 154 of 1991[17] requires that all surface and ground water users be assessed an annual water use fee in the amount of $10 per registered surface water diversion and well. Collected fees provide a cost-share on water conservation practices, administration, and information and education programs.

Subtitle II of Title III[18] of the Commission's Rules set forth the procedures used to register a surface water diversion. All persons who divert surface water must register or report the diversion before March of the following year. Uses exempt from registration include: 1) Diversions of less than 1 acre-foot of water annually, 2) Water diverted from natural lakes or ponds in the exclusive ownership of one person, and 3) Diffused surface water (as defined previously). Each registration report contains the following information:

A. Water used for agriculture:
   1. Number and size of diversion
   2. Name, address and telephone number of user
   3. Crops, livestock, poultry, or fish type grown
   4. Acreage:
      a. Irrigated
      b. Aquacultured
   5. Quantity of water used
   6. Location:
      a. Of the diversions
      b. Of the water use

B. Water used for other than agriculture:
   1. Number and size of diversion
   2. Name, address and telephone number of water user
   3. Use made of the water
   4. Quantity of water used

C. Any other information deemed necessary by the Commission.

[16] 1957 Ark. Acts 81, codified in Ark. Code of Annotated, 15-22-201 through 220.
[17] 1991 Ark. Acts 154, codified in Ark. Code Annotated, 15-22-301-313.
[18] ASWCC Rules and Regulations - Rules for the Utilization of Surface Water, Surface Water Diversion Registration.

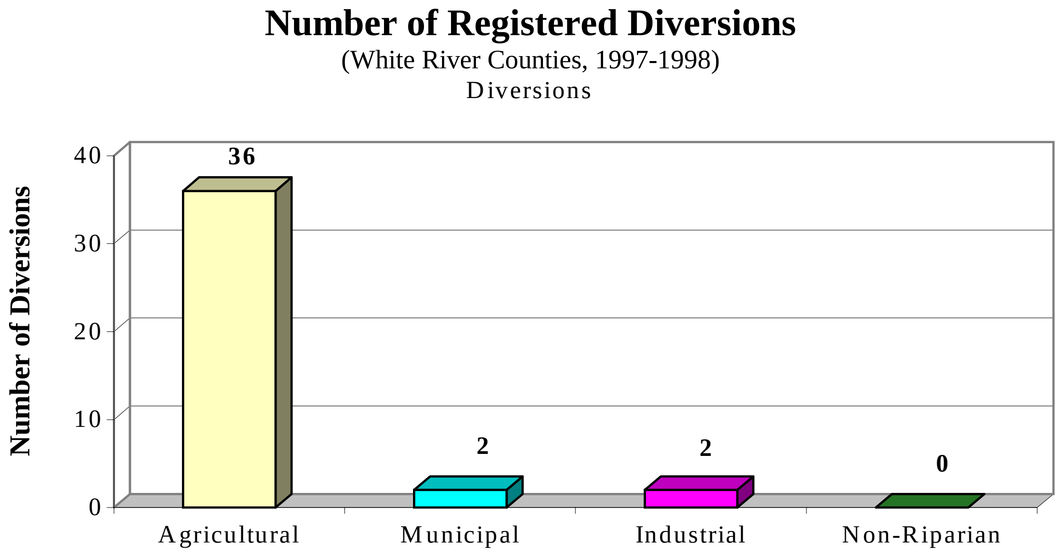


Figure 7. Number of Registered Diversions.

Figure 7 above depicts registered water uses for 1997 and 1998. Of the forty registered diversions for the 1997-1998 year, two were industrial. Availability of White River water is important to out-of-stream use such as industry, agriculture, aquaculture, etc.

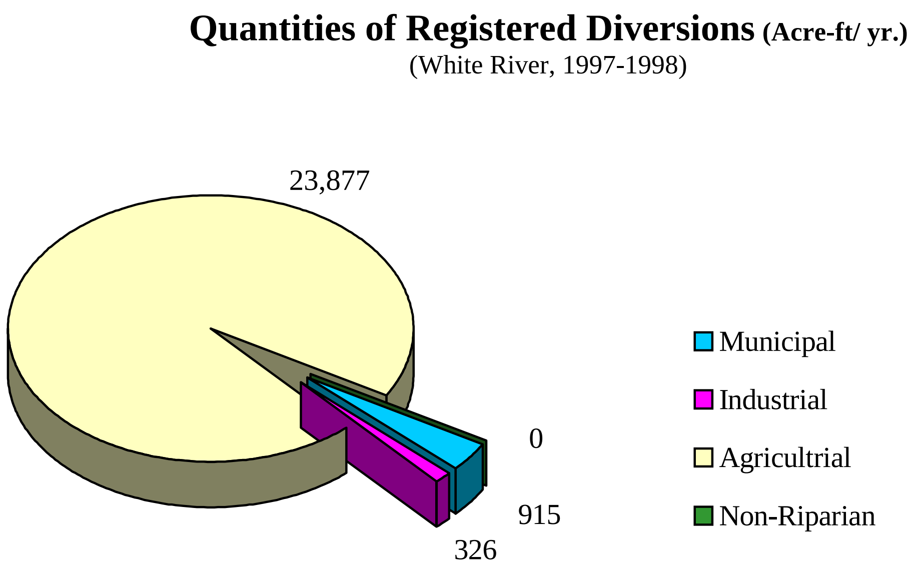
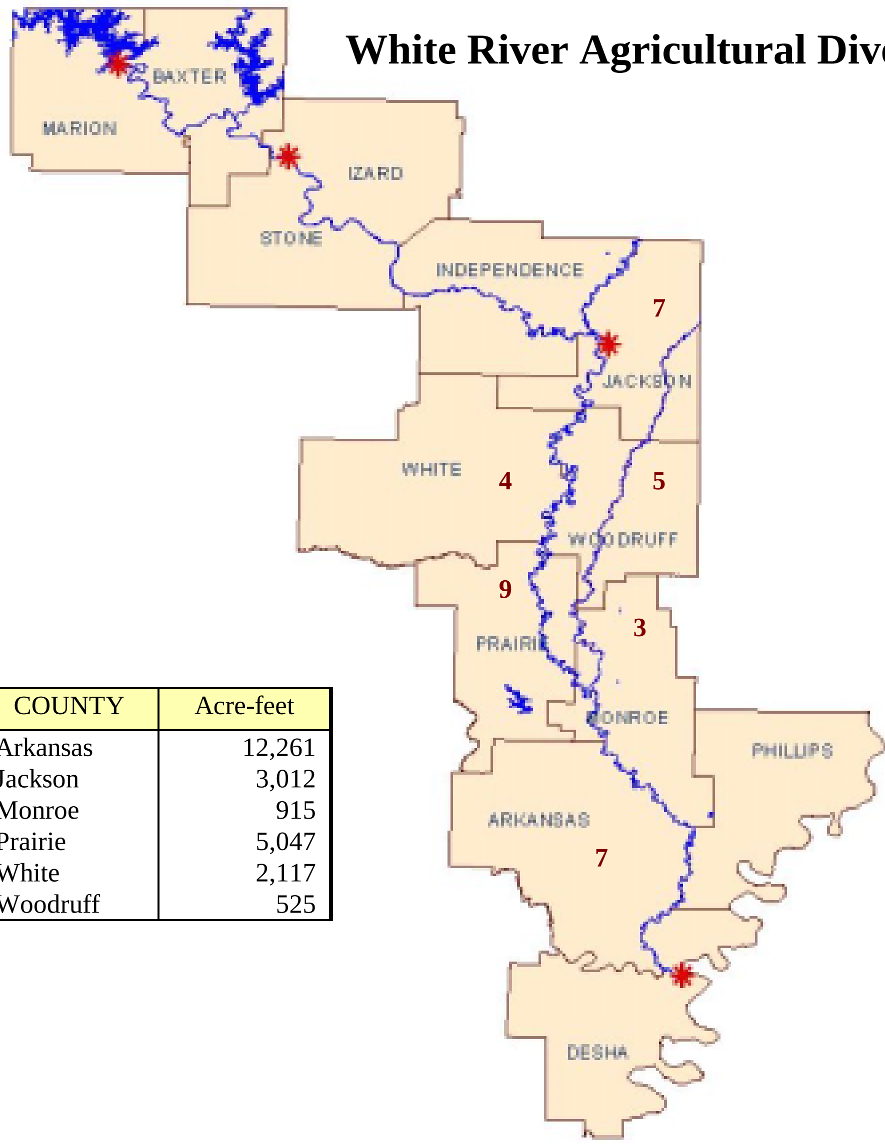


Figure 8. Diversion totals were compiled from 1997 irrigation registrations of pumps on the White River (ASWCC) and 1998 municipal and industrial diversions.

<u>Agricultural Use:</u> Agricultural diversions represent 90 percent of the total number of diversions and consume 95 percent of all registered water diverted (Figure 8, page 23). The primary out-of-stream water use in the White River Basin is agriculture. The majority of croplands along the river are located in the Lower Basin of the White River. Fourteen percent of the water withdrawn for agriculture comes from surface water sources; the other 86 percent comes from groundwater sources. Rice and soybeans are the predominant crops; winter wheat, milo, cotton, sorghum, and corn are other crops grown in the area. Rice irrigation represents 70 percent of all water consumed for crop irrigation.



COUNTY	Acre-feet
Arkansas	12,261
Jackson	3,012
Monroe	915
Prairie	5,047
White	2,117
Woodruff	525

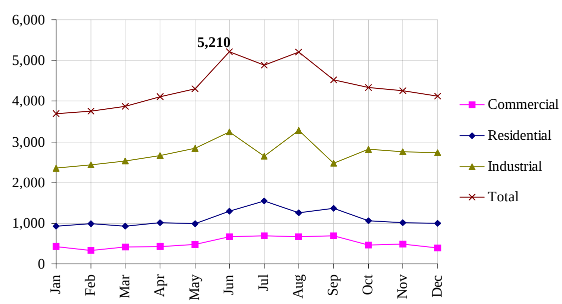
Figure 9. Number of registered agricultural diversions and the amount diverted in acre-feet per year. (One acre-foot equals 325,828 gallons.)

On-Farm water conservation practices today include tailwater recovery systems; pivot, drip, sub-surface and trickle irrigation systems; water control structures; land leveling or contouring; scheduled irrigation; improved tillage practices and surface mulching. The Natural Resources Conservation Service provides assistance to farmers for implementing conservation practices such as those listed above. These practices help eliminate inefficient water use and preserve the state's water resources.

<u>Municipal Use</u>: There are two municipal users diverting from the White River, the cities of Mountain View in Stone County and Batesville in Independence County. Both entities wholesale water to three or more water user associations. Illustrated on the following page are both the historic and projected water consumption rates by each city on a month by month basis (Figure 10A - D, page 25). Current use data was obtained from monthly billing accounts receivable; water uses at the water and wastewater treatment plants, line loss, etc., for total consumption of water diverted from the White River. Trends towards increasing numbers of higher paying jobs and projected increases in construction and manufacturing are expected to increase population growth. Based on the expected increases in population and industry in the area, water requirements for municipal purposes are expected to increase. Projected water usage was based on population and industrial expansions, water conservation programs, and future drinking water standards.

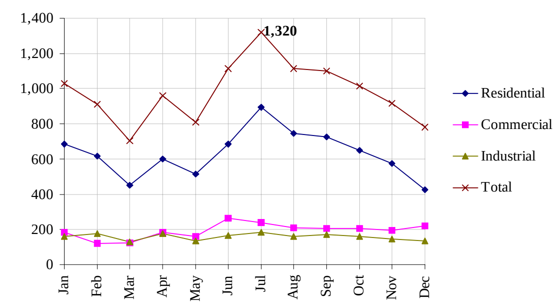
Daily Average Water Use (1,000 gal/ month)
Batesville, 1994

A.



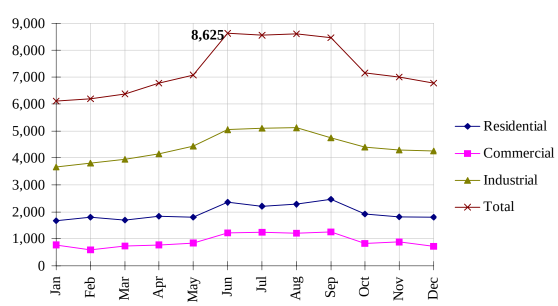
Daily Average Water Use (1,000 gal/ month)
Mountain View, 1994

B.



C.

Daily Average Water Use (1,000 gal/ month)
Batesville, 2014



D.

Daily Average Water Use (1,000 gal/ month)
Mountain View, 2014

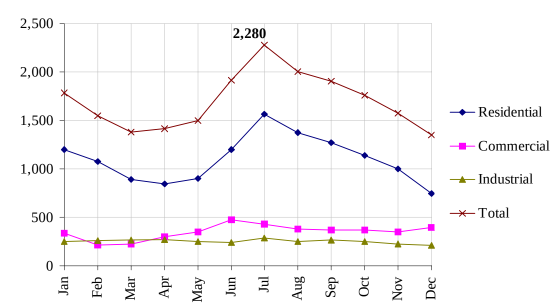


Figure 10. (A. -D.) The cities of Batesville and Mountain View are the only two municipal water systems that treat water from the White River.

Batesville discharges, under NPDES permit, its wastewater into the White River. Mountain View’s permit is for a tributary of the White River. According to the Discharge Monitoring Reports submitted to ADEQ, both cities discharge between eighty-five and ninety-five percent of White River withdrawals back into the river. Withdrawals by Batesville and Mountain View from the river are negligible compared with the total registered diversions from the White River.

Industrial: The only registered industrial users on the White River are the Arkansas Eastman Division and White River Materials, both located within Independence County. Ninety to ninety-five percent of the river water used by industry is for non-contact cooling purposes or material washing. Such industries are non-consumptive water users, in that essentially all the diverted water returns to the White River.

NON-RIPARIAN USE

No permits have been issued for non-riparian diversion from the White River. All non-riparian diversions must obtain a “Non-Riparian Permit”, even though that use may not be entitled to an allocation during times of shortage.

As of June 2000, the only application for non-riparian permit on file with the Commission was from the White River-Grand Prairie Irrigation District project for an intrabasin permit. This proposed project would divert 243,900 acre-ft during each year for irrigation. The U.S. Army Corps of Engineers has designed the Grand Prairie Demonstration Project to alleviate the decline in groundwater levels from extensive irrigation development. This project would provide surface water to supplement irrigation demands on 254,406 acres of cropland.

Act 838 of 1995 amends Arkansas Code 15-22-304 to read as follows:

> “(e) For purposes of transfer of the excess surface water as defined above in the White River Basin, the transfer amount shall not exceed on a monthly basis an amount which is fifty percent (50%) of the monthly average of each individual month of excess surface water.”

This means that the aggregate, or the sum of all non-riparian diversions, may withdraw no more than 50 percent of the monthly available stream flow as determined in the State Water Plan.

Streamflow from the White River (in CFS)

Month	Estimated Mean Monthly Discharge (cfs)	Water Quality	Fish & Wildlife	Navigation	Current Available Streamflow
October	13,840	5,250-5,720	6,920	9,650*	4,190
November	18,420	5,250-5,720	11,050*	9,650	7,370
December	29,310	5,250-5,720	17,590*	9,650	11,720
January	32,680	5,250-5,720	19,610*	9,650	13,070
February	37,840	5,250-5,720	22,700*	9,650	15,140
March	46,010	5,250-5,720	27,610*	9,650	18,400
April	52,770	5,250-5,720	36,940*	9,650	15,830
May	52,340	5,250-5,720	36,640*	9,650	15,700
June	30,320	5,250-5,720	21,220*	9,650	9,100
July	21,340	5,250-5,720	10,670*	9,650	10,670
August	18,180	5,250-5,720	9,090	9,650*	8,530
September	15,040	5,250-5,720	7,520	9,650*	5,390

Table 6. White River streamflow that is currently available on a monthly basis for other uses. * Governing instream flow requirement. (From State Water Plan, East Arkansas Basin Report and the Grand Prairie Area Demonstration Project, "Record of Decision".)

The operation of the Grand Prairie Area Demonstration Project (the "Project") pumping station is conditioned by the operating plan set up by the Corps of Engineers. In its Record of Decision, the Corps of Engineers states that the operational plan for the Project will reflect the varying monthly required instream flows at the Clarendon gage, as analyzed for the Project and set forth in Table 6 above. This will be incorporated into the conditions of any non-riparian permit issued for this project.

CURRENT AND PROJECTED USE

Municipal and Industrial withdrawals are negligible. It is important to note that public water systems historically dependent upon a stream shall receive a reserved water right for municipal domestic water use prior to allocations for other uses. Under the rules established by the Commission[19], Subtitle VII of Title III reserves water required for domestic and municipal domestic use, federal water rights and for minimum stream flow and then gives preference to: agriculture, industry, hydropower, and recreation.

[19] ASWCC Rules and Regulations - Title III, *Rules for the Utilization of Surface Water*, Subtitle VII

“IN-STREAM” FLOW NEEDS

AQUIFER RECHARGE

Aquifer recharge occurs locally along the White River where the river is in direct hydraulic connection with the aquifer. Aquifer recharge depends on the head in the aquifer and the stage of the stream. Ordinarily the stream recharges the aquifer during periods of low stage (Figure 11A, page 29). Stream-aquifer interaction is accomplished primarily through bank storage (Figure 11C, page 29), which creates a water-level mound. Bank storage establishes the hydraulic gradient that determines whether the aquifer or the stream will be recharged.

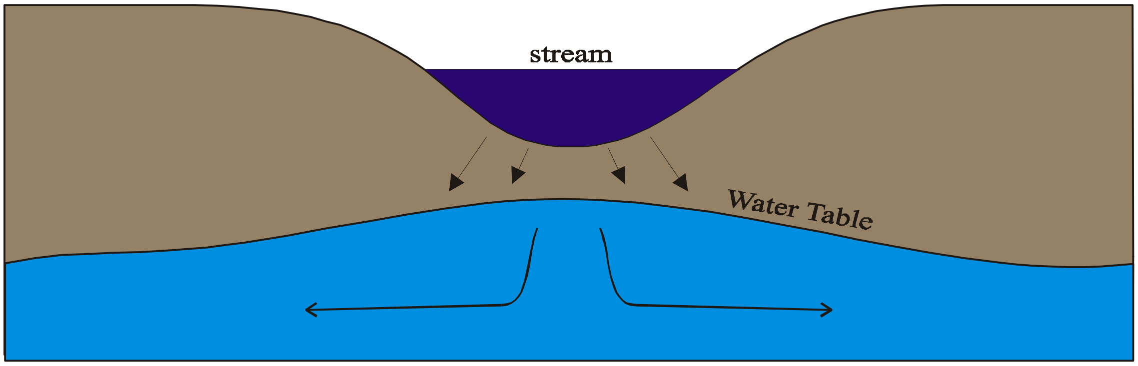
The aquifer recharge from bank storage is an important, yet relatively small volume of the total recharge. Much greater volumes of water provided to the ground-water system through floodplain percolation during over-bank flooding typically occurs during the winter and spring months. This recharge is greatest in areas with highly permeable surface lithologies such as the alluvial sand found in the floodplain along the White River.

The U.S. Geological Survey has conducted studies of the effect of river stages on adjacent alluvial aquifers in Arkansas. Some of these studies were developed in the Arkansas River area, which is more hydraulically connected to the aquifer than the White River[20]. However, these and other studies provide general information on stream and aquifer interaction in the eastern Arkansas Delta region. In most cases, the hydraulic gradients in the alluvial aquifer indicate that the river is losing water to the adjacent aquifer. The effect on ground-water levels is pronounced at distances less than two miles from the Arkansas River. A one-foot rise in the river-stage may raise the aquifer .57 foot at a distance of five miles[21].

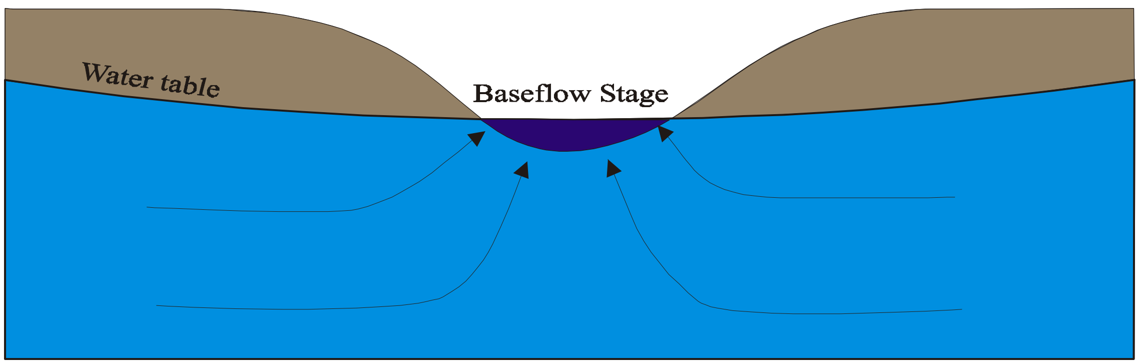
The upper White River, from Bull Shoals to just beyond Batesville, flows through the Upper White River Basin. The basin is an area of sustained base flow during dry weather conditions, which is evidence that aquifers are not accepting recharge, but rather discharging water to the streams[22]. Discharges from aquifers sustain the base flow of these streams. Figure 11B, page 29, is an illustration of an effluent river (a stream that receives water from adjacent aquifers). Therefore, aquifer recharge requirements are currently being met in the Upper White River Basin. However, if ground-water level were drawn below the level of the streambed, the aquifer recharge requirements would need to be considered.

[20] Mahon, 1992
[21] Friewald and Grosz, 1988
[22] Hines, 1975

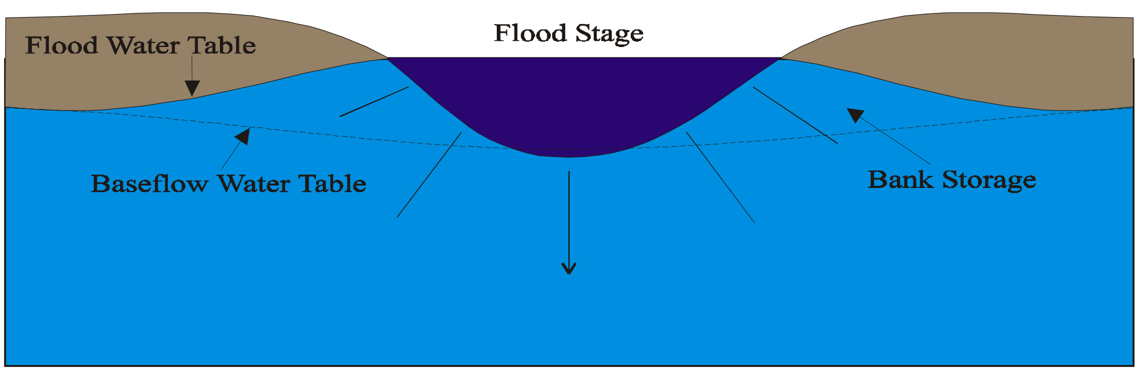
Typical Stream Aquifer Relations



A



B



C

Figure 11(A - C) Stream and aquifer relations depend on the stream stage and groundwater level. Flood conditions may lead to a quick influx of an aquifer, were a stream in a low water situation may be influenced by the aquifer's influx.

The lower White River, from just beyond Batesville to the Arkansas River, flows through the Eastern Arkansas Basin. In portions of the Eastern Arkansas Basin, a clay-confining unit overlies the alluvial aquifer. The White River fully penetrates the clay-confining unit[23], thus providing some hydraulic connection with the alluvial aquifer. Stream to aquifer interaction is greater where the alluvial material is sand.

Hydraulic interaction between the White River and the alluvial aquifer can be best illustrated by selected hydrographs along the White River (Figures 12-16, pages 30-34) where river levels and groundwater levels parallel. These hydrographs also indicate whether the White River is gaining water from - or losing water to - the alluvial aquifer.

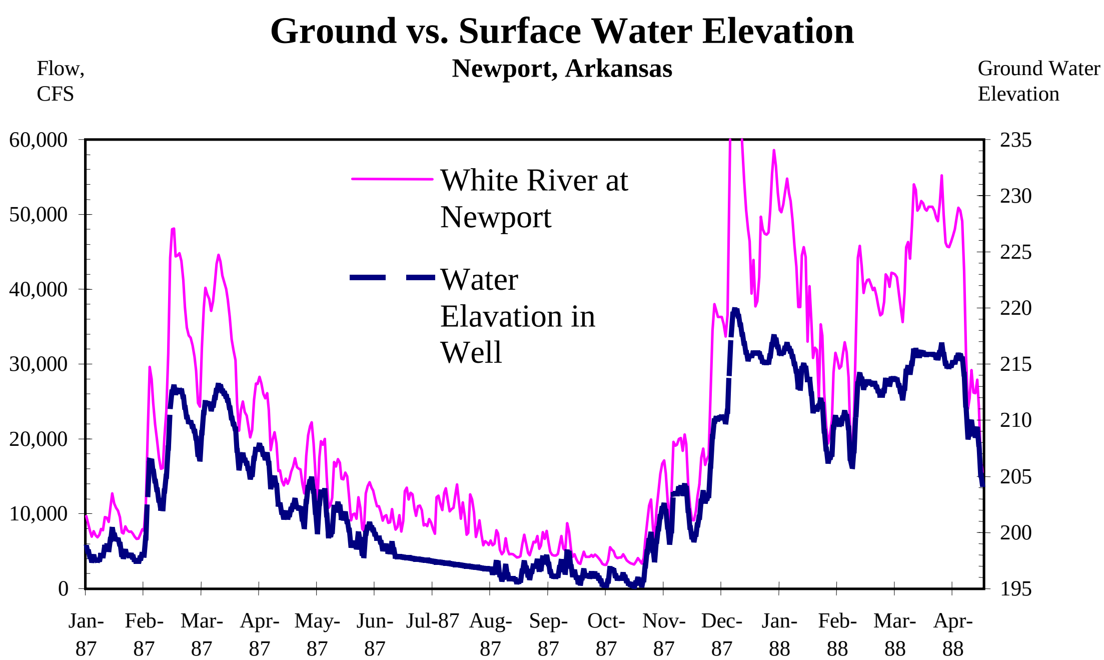


Figure 12. Hydrographic depiction of fluctuations of stage for the White River at Newport, Arkansas and water levels in a nearby well (#353617091172001).

At Newport, the groundwater levels are above the river levels (Figures 12 & 13, pages 30 and 31). When this occurs, the White River acquires water from the alluvial aquifer during low flow seasons. Ground-water recharge occurs only during the winter and spring seasons. Recharge to the aquifer during high river flows is about 0.113 cubic feet per second (cfs) or 0.224 acre-feet per day for every mile of river reach based on hydrograph data for this area and the streambed conductance formula[24]. This will effectively recharge a single well pumping at 1,000 gallons per minute for less than two hours. Since pumping will commonly occur during the summer months, the

[23] Ackerman, 1989.
[24] McDonald and Harbaugh, 1985.

Aquifer, in effect, serves as a storage area. This is a conjunctive use pattern, allowing water users to rely on the more robust ground-water resource during the low flow months.

Figures 12 and 13, pages 30 and 31, reveal that river levels decline below the ground-water levels during the low flow season and that no recharge to the aquifer is occurring. Consequently, ground-water levels must be carefully protected to prevent base flow to the river from being depleted. These hydrographs also depict the importance of the winter and spring seasons and how they affect the recharge to the alluvial aquifer. The aquifer is discharging to the river during the summer months when pumping for irrigation is taking place; therefore, there is no aquifer recharge to protect.

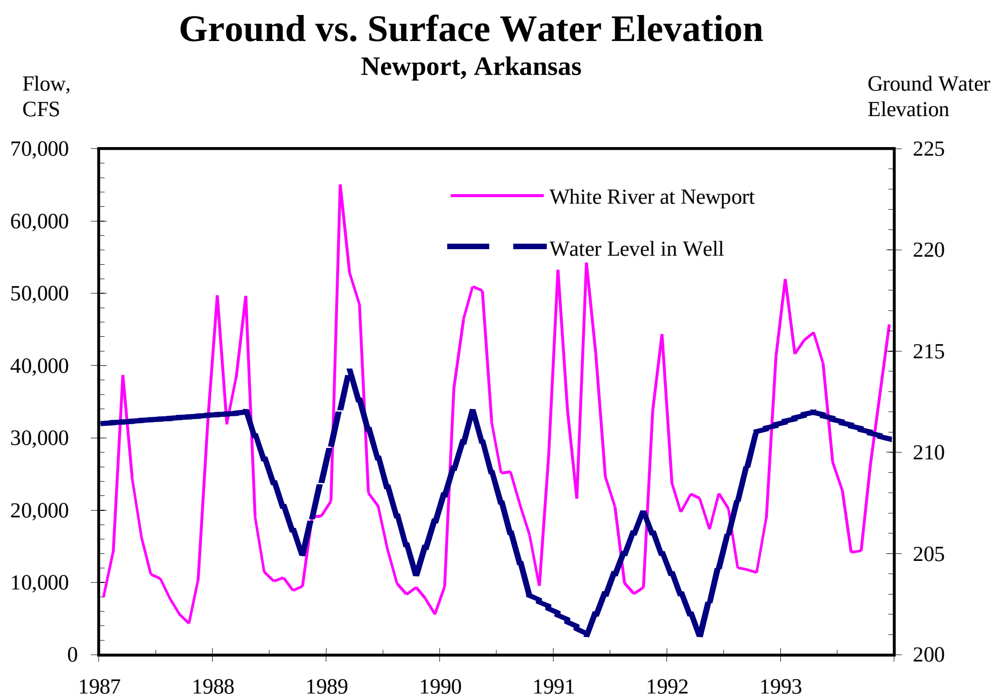


Figure 13. Hydrographic depiction of fluctuations of stage for the White River at Newport, Arkansas and water levels in a nearby well (#353542911515).

The interaction between stream and aquifer is different at Augusta, Georgetown, and St. Charles (see Figures 14-16, pages 32-34). River levels are perennially above groundwater levels, indicating that the White River is losing water to the alluvial aquifer (Figure 11A, page 29). This is partly a result of extensive groundwater pumping for irrigation east of the White River, which lowers the potentiometric surface of the alluvial aquifer. Ground-water levels are as much as 100 feet below the elevation of the river. This general hydraulic gradient establishes an inevitable recharge from river to aquifer. This recharge will occur as long as any water remains in the river channel, because ground-water recharge takes place along the channel bottom and sides regardless of any other instream needs.

A ground-water flow model of the alluvial aquifer developed by the U.S. Geological Survey[25] provides general estimates of aquifer and stream exchange. For the river reach between the Little Red River confluence and the Arkansas River, the model has estimated the recharge rate to the alluvial aquifer at 73 cfs. The discharge rate from the alluvial aquifer to the river along this reach is estimated at 3 cfs. Therefore, the total flux between

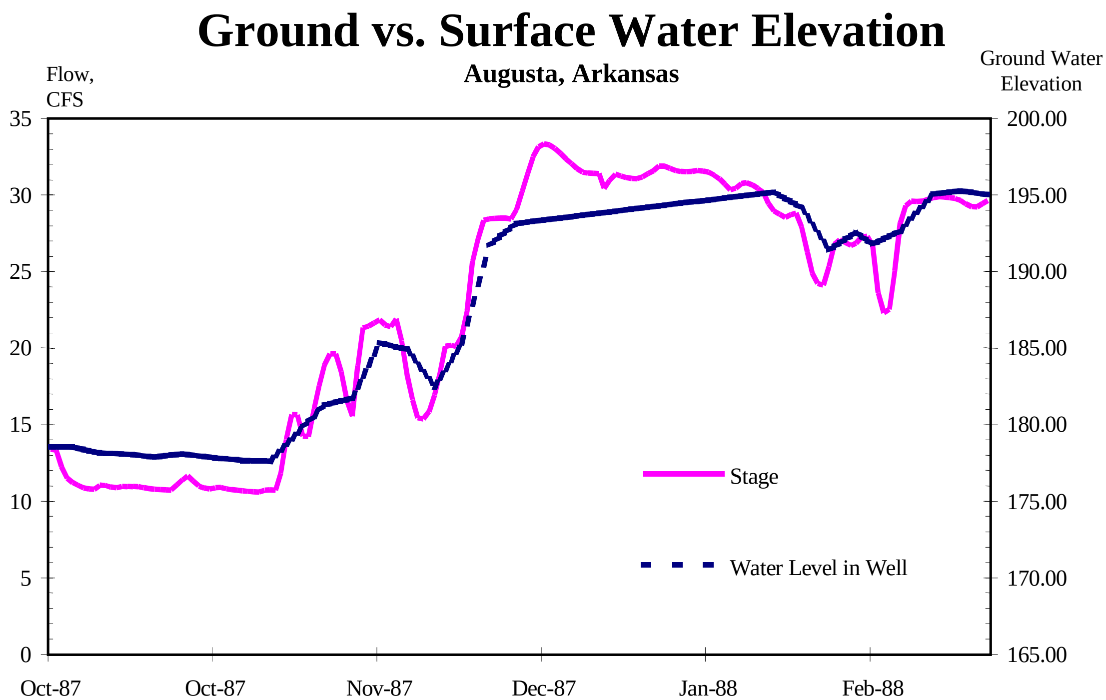


Figure 14. Hydrographic depiction of fluctuations of stage for the White River at Augusta, Arkansas and water levels in a nearby well (#351757091234101).

the White River and the alluvial aquifer is 70 cfs along the river reach. Seventy cubic feet per second is equivalent to 139 acre-feet per day, or about 32 wells pumping at 1000 gpm. These values are for the end of a five-year stress period that uses pumping estimates for 1985. The river stages used in the model are mean values for the period of record.

The average river level during the months of October through March is 214 feet above mean sea level, based on hydrograph data in Figures 12-16, pages 30-34. The average ground-water level during this time is 212 feet above mean sea level. This hydraulic gradient does not provide a recharge of 70 cfs to the aquifer along the river. This further illustrates the importance of the spring and winter floodplain recharge.

Potentiometric surface maps of the alluvial aquifer further support the hydrograph data[26]. The cone-of-depression in the potentiometric surface of the alluvial aquifer east of the White River has drastically altered the natural hydraulic gradient of the aquifer.

[25] Mahon, 1992.

[26] Gonthier and Westerfield, 1992; Westerfield, 1990; Plafcan and Remsing, 1989; Plafcan and Fugitt, 1987.

Consequently, the river below Augusta functions as a constant source of recharge to the aquifer. Unless the aquifer levels return to pre-development levels, groundwater recharge in the direction of the cone-of-depression will continue to occur regardless of the relatively minor changes in stream water levels. Specific hydrograph comparisons reflect the similarity of well water levels to those of the river.

The streambed conductance formula[27] illustrates that a river level of one foot above the adjacent groundwater table will provide recharge to the aquifer of about .045 acre-feet per day for each mile of the White River (Table 7, page 33).

STREAM/AQUIFER HYDRAULIC INTERACTION

hriv(ft)	hwell(ft)	(hriv-hwell)	Qriv(cfs)/reach	Qriv(acre-feet/day)
212.0	211.0	1.0 ft	5.65	0.045
214.0	212.0	2.0 ft	11.31	0.09
220.0	210.0	10.0 ft	56.53	0.45
218.0	203.0	15.0 ft	84.79	0.67

Streambed Conductance Formula:
Qriv = (K*L*W/M)(hriv-hwell)

Where: K = vertical hydraulic conductivity = 0.01 ft/day
L = river reach length = 5280 ft
W = river width = 370 ft
M = riverbed stratum thickness = 10 ft
hriv = river head (elevation) = variable
hwell = well head (potentiometric surface) = variable
reach = 250 miles(from Newport to the confluence with the Arkansas River)

Table 7. Streambed Conductance Formula, MacDonald and Harbaugh, Modflow, U.S. Geological Survey.

[27] MacDonald and Harbaugh, 1985.

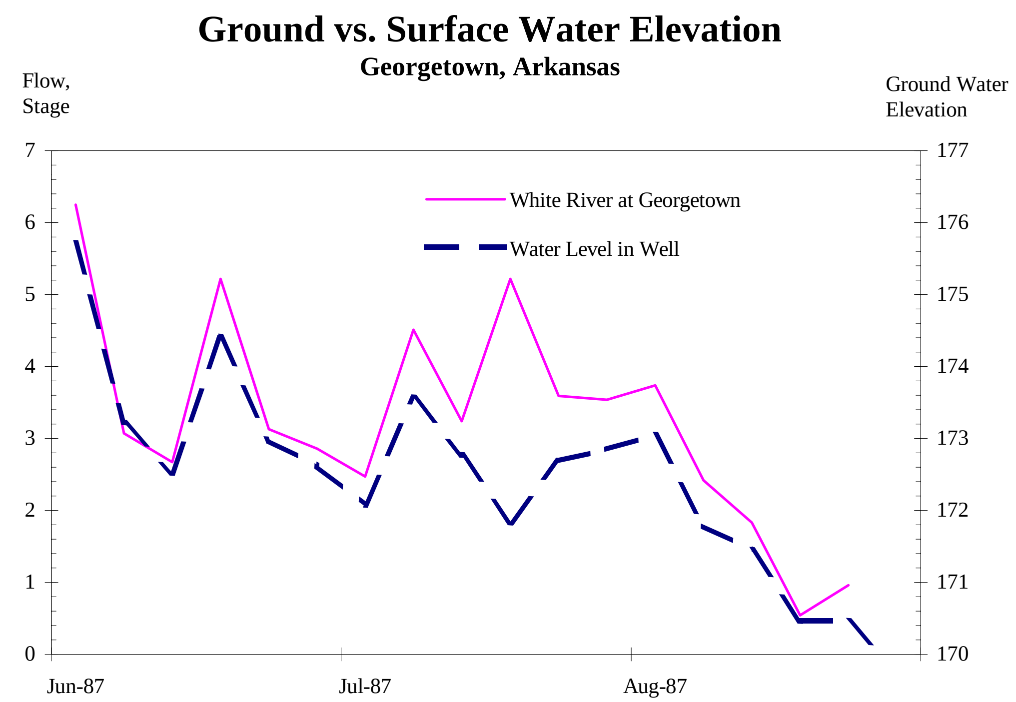


Figure 15. Hydrographic depiction of fluctuations of stage for the White River at Georgetown, Arkansas and water levels in a nearby well (#350745091270001).

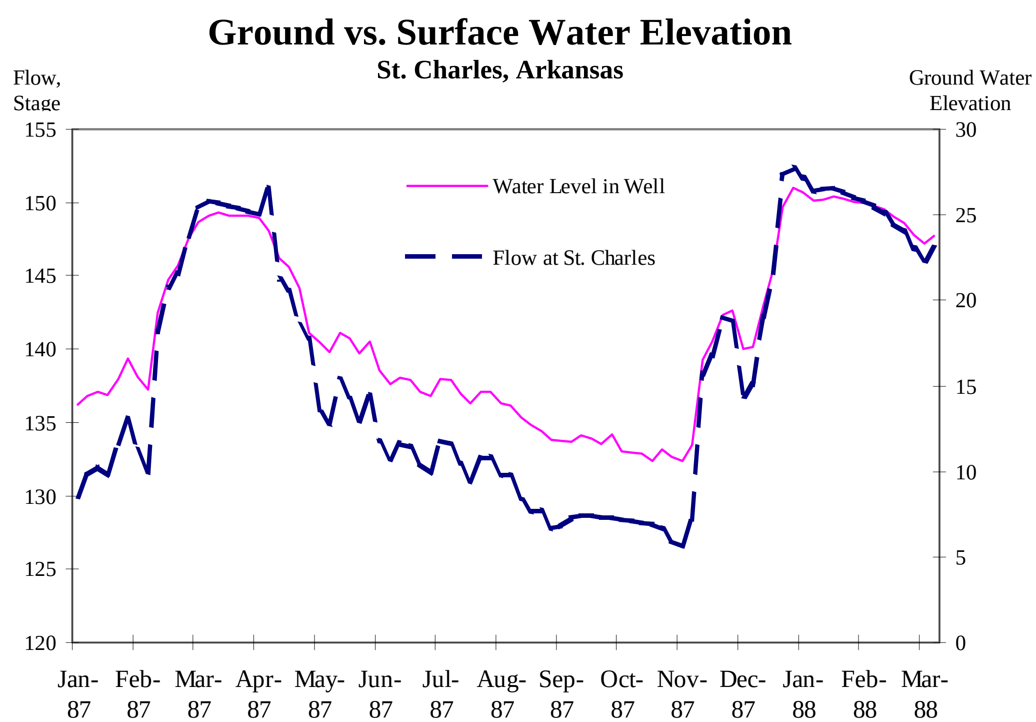


Figure 16. Hydrographic depiction of fluctuations of stage for the White River at St. Charles, Arkansas and water levels in a nearby well.

This would provide recharge necessary for one 1,000 gpm well for about 15 minutes each day. Obviously, recharge of this magnitude is of minimal significance. High-flow season and surface percolation recharge are the primary sources of recharge.

The estimated area of alluvial aquifer receiving recharge from the White River is about three million acres. The total recharge to this area is about 306,735 acre-feet per year, which is equal to about 1162 wells pumping at 1,000 gpm for 60 days. A conservative estimate of recharge from surface percolation to the alluvial aquifer is about 1 inch per year[28] or about 265,000 acre-feet per year. Aquifer recharge from the river at a volume of 70 cfs or 50,735 acre-feet per year is about 17 percent of the total recharge to the aquifer in this area.

The commission is working with the U.S. Geological Survey in using the ground-water flow models to optimize and conserve water use through a conjunctive use strategy. The management strategy of the Commission is to protect minimum saturated thickness of aquifers and base flow to streams during the low-flow season, while also protecting the recharge to aquifers from streams during the high-flow season. The State's water-level monitoring network determines the recharge conditions along streams.

Accordingly, the water resource investigation has used flow nets, hydrographs, the Streambed Conductance Formula, and a groundwater flow model to evaluate the stream to aquifer interaction between the White River and the adjacent aquifers. It appears that the groundwater system is rejecting recharge along the river reach upstream from Newport. However, downstream from Newport through the East Arkansas Delta, the river is an influent river that loses water to the ground-water system in the direction of the cone-of-depression. Along this reach, the hydraulic gradient allows constant recharge from the river to the aquifer. The recharge of the aquifer occurs in greatest volume during the winter and spring when stages are highest and there is minimal pumping from the river.

The U.S. Geological Survey data obtained with the ground-water flow model indicates recharge to the aquifer is at a rate of about 70 cfs, or about 51,000 acre-feet per year for the river reach from Newport to the Arkansas River. Maintaining the flow rate of 70 cfs for the reach (which is an approximate value based on existing hydrologic and climatic conditions) can protect groundwater recharge. Current rates of groundwater recharge will continue as long as the spring floods continue. Therefore, as long as any single instream flow requirement is protected, then the ground-water recharge is protected.

[28] Mahon, 1993

WATER QUALITY

The 7Q10 low-flow characteristic is a common criterion used by state and federal agencies to determine the permissible rate of waste disposal into a stream. The most important factor influencing concentration of dissolved solids in streamflow is the volume of water available for dilution. The 7Q10 is defined as the minimum average daily flow that occurs for seven consecutive days in a ten-year period.

The Arkansas Department of Environmental Quality (ADEQ) is responsible for the management of water quality conditions in the State. The 7Q10 discharge is the minimum flow at which ADEQ conditions their effluent permits to maintain streamflow contaminant concentrations at acceptable levels. However, due to a lack of sufficient streamflow at times during the year, water quality standards may not be met every day during a certain year.

Regulated streams are addressed by ADEQ on a case-by-case basis to establish the flow required in maintaining acceptable streamflow contaminant levels. Five reservoirs in Arkansas affect flow conditions in the White River. These reservoirs and the year(s) they were constructed are Norfork (1941-1944), Bull Shoals (1947-1951), Table Rock (1957), Greers Ferry (1962), and Beaver (1959-1965). In determining 7Q10 low-flow characteristics for the White River, only streamflow records since 1951 (the construction of Bull Shoals reservoir) were used (see Table 8, page 37). If significant changes are made in the methods of reservoir regulation upstream, the 7Q10 values determined must be recalculated.

The 7Q10 discharges at ungaged locations on the river cannot be statistically quantified. Extrapolation of the 7Q10 indices should not be attempted without knowledge of the basin characteristics and human practices. This is especially true of the White River from Flippin to Calico Rock, where flow is not evenly distributed. In this river reach, 7Q10 values increase 4.5 times and the drainage area only increases 1.5 times. This ratio indicates that the White River is gaining large quantities of ground water from underlying aquifers. Because 7Q10 values increase disproportionately to the drainage area, and the exact locations of increased flow from ground water sources are unknown, extrapolation of 7Q10 indices at ungaged locations should not be attempted within this reach.

The 7Q10 discharge needs were reviewed and it has been determined that the flow required for maintaining fish and wildlife is greater than the discharge requirements needed to provide an acceptable streamflow contaminant level. Therefore, the flow requirements needed to sustain fish and wildlife will also meet water quality requirements in the White River.

Gaging Station 7Q10
(White River, 1951 - 1990)

Gaging Station	Period of Record	7Q10 (cfs)
Flippin (07055000)	1953-1980	219
Calico Rock (07060500)	1953-1990	1,020
Newport (07074500)	1953-1990	4,150
DeValls Bluff (07077000)	1951-1970	4,830
Clarendon (07077800)	1952-1981	5,240

Table 8. The 7Q10 discharges required to meet water-quality standards were calculated at five gaging stations located on the White River using streamflow records since 1951[29].

FISH AND WILDLIFE

The following fish and wildlife section is the result of work completed by a workgroup composed of representatives from:

- Arkansas Department of Parks & Tourism;
- Arkansas Game & Fish Commission (AGFC);
- United States Fish & Wildlife Service (USFWS);
- Arkansas Scenic Rivers Commission;
- Arkansas Department Environmental Quality;
- Ozark and St. Francis National Forest Service;
- White River Valley Association; and
- Arkansas Natural Heritage Commission.

Streams and rivers are very dynamic systems relative to flow, water level fluctuations, temperature regimes, dissolved oxygen minimum and maximums, and numerous other parameters. Because of this dynamism, modeling and quantification of such environmental variables as flow has been difficult. Four of the best-known methods for quantifying instream flows are; 1) single transect methods, 2) multiple transect methods, 3) multiple regression analysis methods, and 4) discharge methods. These methods require varying amounts of funding and labor to undertake, and only the discharge methods, (and, to a lesser degree, the single transect methods) allow a quick determination of instream flows for numerous stream reaches. The AGFC developed a method that combines historic hydrologic records for Arkansas streams, fisheries and flow sampling with knowledge of natural, seasonal processes, and recreational needs that occur in the state’s six physiographic regions. This method is described as a discharge to wetted perimeter technique, and is termed the "Arkansas Method" of instream flow reservation[30].

[29] Gus Ludwig, U.S. Geological Survey written communication, 1991.
[30] Filipek et al., 1988.

The relationship between a river's water level and the wetted perimeter associated with that level is shown in Figure 17, page 39. The Arkansas Method is a modification of an accepted technique, the Montana Method[31], and a process that takes into account the differences in hydrology and precipitation as well as fish species habits and life cycles between Arkansas and Montana.

The abstract from the Instream Flow Regimens for Fish, Wildlife, Recreation and Related Environmental Resources by Donald L. Tennant, or better known as the "Montana Method", best describes the methodology for determining protective flows for aquatic streams.

> "The 'Montana Method' is a quick and easy methodology for determining flows to protect the aquatic resources in both warm-water and cold-water streams based on their average flow. With this method, biologists do their analysis with the aid of hydrological data provided by the U.S. Geological Survey. Detailed field studies were conducted on eleven streams in three states between 1964 and 1974, testing the 'Montana Method.' This work involved physical, chemical, and biological analyses of thirty-eight different flows at fifty-eight cross-sections on 196 stream-miles, affecting both cold-water and warm-water fisheries. **. . .** The studies were planned, conducted, and analyzed with the help of state fisheries biologists. Results reveal that the condition of the aquatic habitat is remarkably similar on most of the streams carrying the same portion of the average flow. Similar analyses of hundreds of additional flow regimens near USGS gages in twenty-one different states during the past seventeen years substantiated this correlation on a wide variety of streams. Running waters studied ranged from small precipitous brooks high in the Rocky Mountains to large, low-gradient rivers and streams out on the prairies of mid-America or along the coastal plains. Results are consistent from stream to stream or state to state, and it is impossible to get a zero flow recommendation using this method. Ten percent of the average flow is a minimum instantaneous flow recommended for sustaining short-term survival habitat for most aquatic life forms. Thirty percent of the average flow is recommended as a base flow to sustain good survival habitat for most aquatic life forms. Sixty percent of the average flow is recommended to provide excellent to outstanding habitat for most aquatic life forms during their primary periods of growth and for the majority of recreational uses."

Recommended allocation levels for fish and wildlife requirements (Table 10, page 42) which trigger formal and intense water conservation methods were computed using various methods. These include the St. John's River Instream Flow Method, wetland vegetative surveying, paddlefish radio telemetry work and the *"Arkansas Method"*. Allocation flows are set above a rigid shut-off flow so that water users can all "share the pain" in respect to water rationing and be curtailing water use before the shut-off level is reached.

[31] Tennant, 1976.

In recommending the fish and wildlife minimum instream flows for the White River, the workgroup used the available data on instream flow recommendations from the Arkansas Game & Fish Commission and USFWS. USFWS recommendations were determined using a multiple transect method termed the Instream Flow Incremental Methodology (IFIM) which is a nationally known and accepted technique for setting instream flows base on hydraulics and habitat and species relationships. In cases where an IFIM study has not been done on a stream in Arkansas, after the allocation flow has been compromised, the minimum or shut-off flow was set close to the 75% exceedence value. The subcommittee's recommendations also incorporate seasonality into the instream flow needs, since a single flow recommendation does not account for all the flow needs in the life cycles of fish and wildlife found in Arkansas (see Figure 18, page 40).

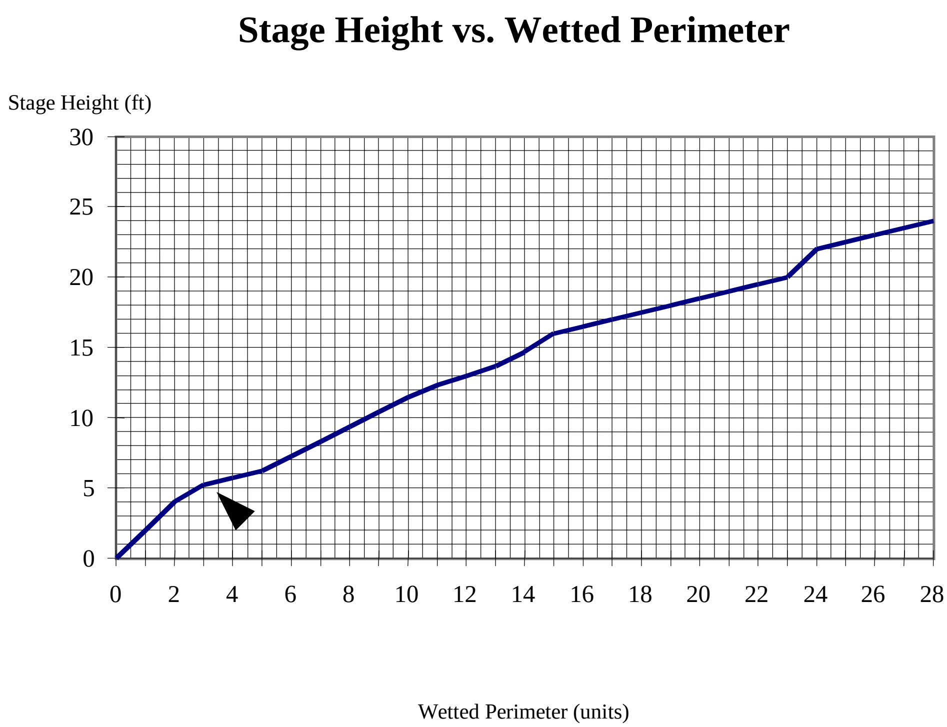


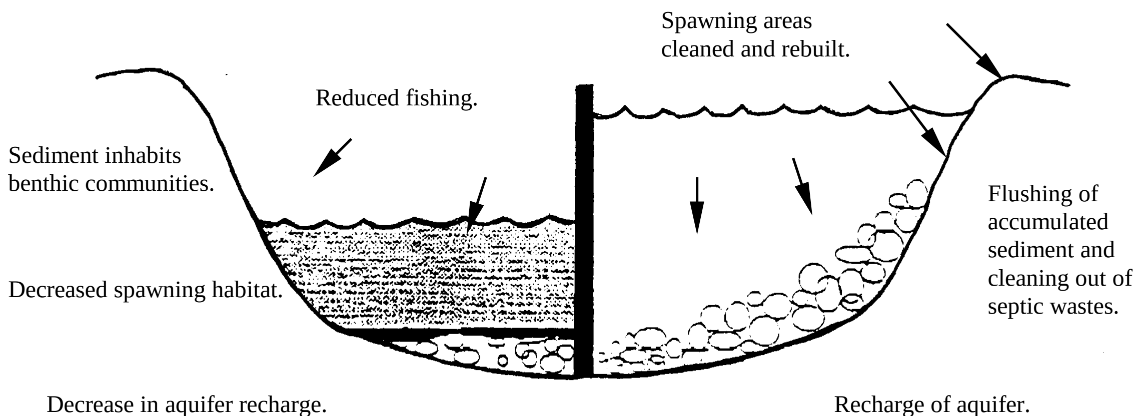
Figure 17. The relationship between river level and wetted perimeter is shown for a cross section of a typical stream in Arkansas. The arrow designates inflection point/minimum flow for the low flow seasons.

Fish generally need high flows in the spring for spawning, and in the winter to clean spawning and nursery areas that also help recharge the groundwater table. Fish also need lower flows in the summer and fall for growth and production. If a single flow is established and one of the life cycle requirements of a fish or wildlife species is not met, survival will be decreased and maintenance of the population will be jeopardized. Table 9, page 41, describes the three seasons of the *"Arkansas Method"*.

Arkansas Method

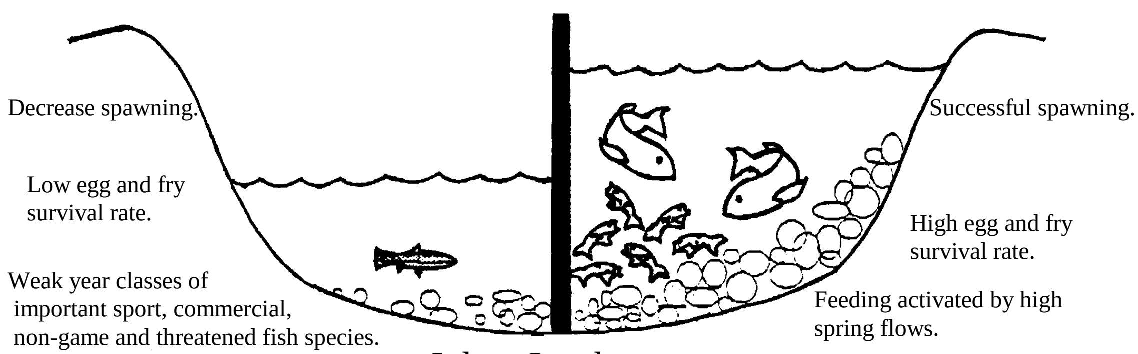
November - March

A period of high average monthly flow, low water temperatures, and high content of dissolved oxygen.
Required flow is **60**% of the Mean Monthly Flow



April - June

A period of high average monthly flows, increasing (preferred) water temperature, high dissolved oxygen content.
Required flow is **70**% of the Mean Monthly Flow.



July - October

A period of low average monthly flows, high water temperatures, and low dissolved oxygen.
Required flow is **50**% of the Mean or Median Monthly Flow.

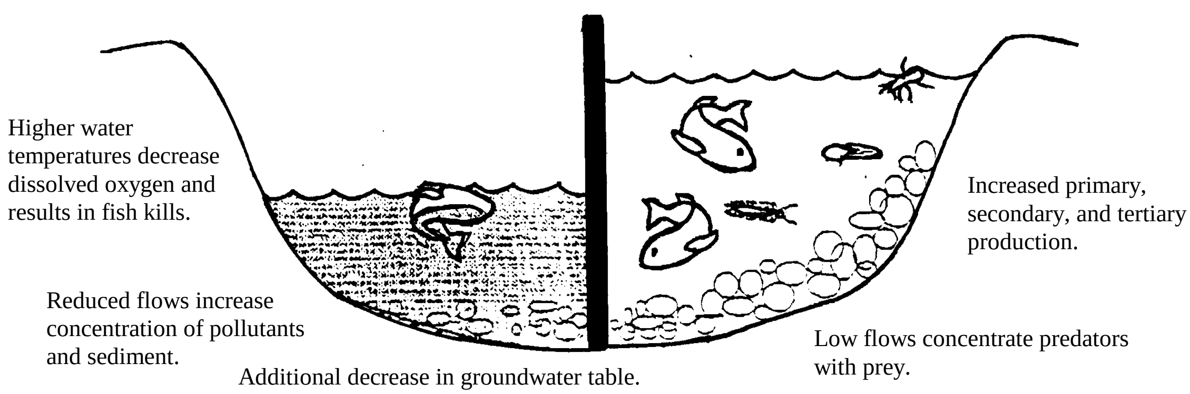


Figure 18. Seasonal life cycle flow requirements- ***" Arkansas Method."***

"Arkansas Method"

TIME OF YEAR	November-March	April-June	July-October
FLOW REQUIRED	60% of Mean Monthly Flow	70% of Mean Monthly Flow	50% of the Mean Monthly Flow
Physical/Biological Processes Involved	Clean & Recharge	Spawning	Production
Normal Conditions	-High average monthly flows. -High dissolved oxygen content. -Flushing of accumulated sediment & cleaning out of septic wastes. -Spawning areas cleaned & rebuilt by gravel & other substrate brought down river by high flows. -Recharge of groundwater (aquifer)	-High average monthly flows. -High dissolved oxygen content. -High flows & increasing water temperatures spur spawning response in fish to spawn: 1) in channel 2) in over-bank area or 3) upriver after migration. -Feeding also activated by high spring flows.	Low average monthly flows. -High water temperatures increase primary, secondary & tertiary production. -Low dissolved oxygen common. -Low flows concentrate predators (fish) with prey (invertebrates, forage fish).
Limiting Factors	-Reduced flow at this time of year decreases the benthic production due to accumulated sediment on substrate. -Decrease in fish spawning habitat due to reduced flushing. -Decrease in aquifer recharge.	-Reduced flow at this time of year decreases spawning egg & fry survival & overall reproductive success of important sport & non-game fish. -Weak year classes of important sport, commercial, non-game and threatened fish species.	-Reduced flows at this time of year cause: Water temperatures to increase, decreasing survival of certain fish species. -Decrease in wetted substrate & therefore decrease in algae, macro-invertebrates. -Decrease in dissolved oxygen due to higher water temperatures; fish kills. -Increase concentration of pollutants & sediment in water. -Additional decreases in groundwater table.

Table 9. The AGFC has adopted the "Arkansas Method" to describe flows needed to sustain wildlife in the streams of Arkansas. Normal conditions and the affects of low flows are depicted for three periods in a year.

There is also a separate spawning season (late February to mid-May) for the paddlefish, sturgeon and other obligate riverine fish. The White River is the home to the largest paddlefish population in Arkansas, and arguably, in the Mississippi River drainage[32]. The AGFC determined the paddlefish's spawning requirements using radio-telemetry equipment to monitor their spawning movements and responses. This fish requires added protection because it is a candidate species on the Federal Endangered Species List. Its spawning season is short and is early in the year when irrigation and other off-stream needs are minimal. The paddlefish has stringent spawning requirements and they have been extirpated in several states and rivers due to alteration of flow regimes[33].

Fish and Wildlife Recommended Allocation Levels

GAGE SITE	SEASON	ALLOCATION		SHUT-OFF	
		Flow (cfs)	Gage Ht.(ft)	Flow (cfs)	Gage Ht.(ft)
Calico Rock	Winter	4,200	3.8	2,000	2.4
	Spring	5,900	4.5	2,000	2.4
	Summer	3,000	2.9	2,000	2.4
Batesville	Winter	7,000	8	5,000	7.5
	Spring	16,000	9.6	9,000	8.4
	Paddlefish Spawn	30,000	11.4	25,000	10.8
	Summer	3,200	7.1	2,500	6.8
Newport	Winter	15,000	6.6	9,000	2.9
	Spring	26,000	12.1	17,000	7.7
	Paddlefish Spawn	59,000	23.6	50,000	21.5
	Summer	8,400	2.5	6,000	0.7
DeValls Bluff		Need additional data (monthly mean flows)			
Clarendon	Winter	49,200	26	19,000	16.9
	Spring	30,000	22.1	23,000	18.9
	Paddlefish Spawn	59,000	27.1	50,000	26.1
	Summer	9,000	10.4	6,800	8.8

Table 10. Fish & Wildlife, Water Quality & Recreation Workgroup's recommendations on allocation and minimum flows for the White River.

[32] Farwick, 1989.
[33] Purkett, 1961.

INTERSTATE COMPACT

This document addresses the White River from Bull Shoals Dam to the mouth of the Mississippi River. This stretch of the river lies within the state of Arkansas, and as of the time of this report, there exists no interstate compacts for this portion of the White River.

NAVIGATION

Existing Navigation Project

Commercially Navigable Waterways

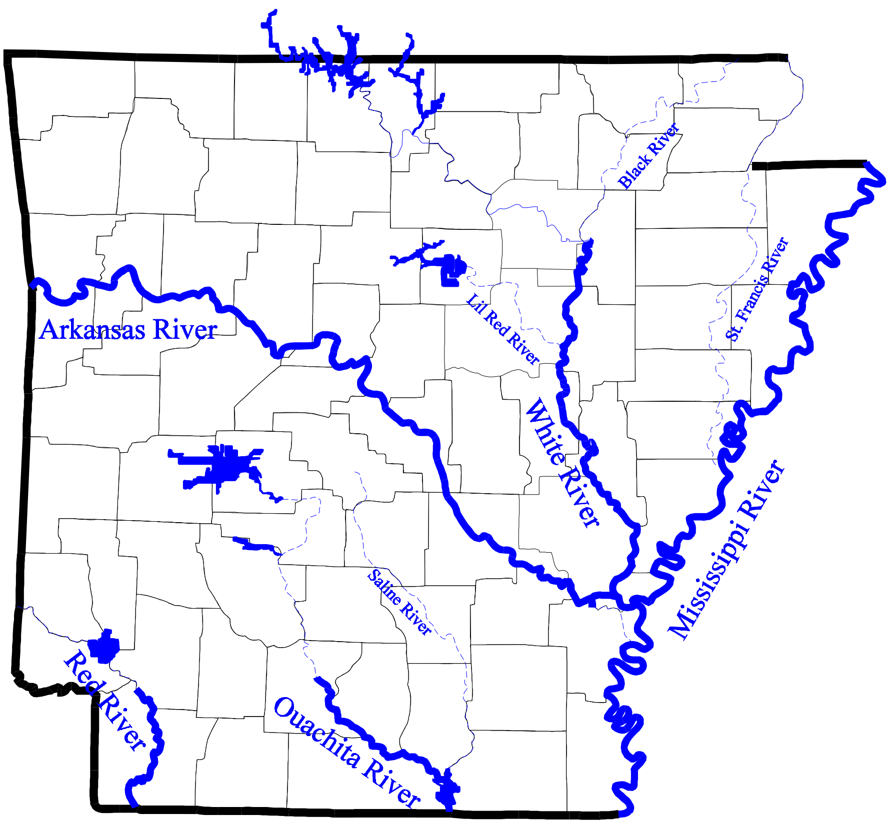


Figure 19. The river systems in bold blue lines indicate the streams that are maintained for commercial navigation. The White River Navigation Project authorizes the Army Corps of Engineers to maintain minimum channel widths and depths from river mile 10 to mile 254 on the White River.

The U.S. Army Corps of Engineers is responsible for maintaining the currently authorized White River Navigation Project. From mile 10 (Arkansas Post Canal) upstream to mile 198 (Augusta), the project provides for a minimum channel width of 125 feet with an 8-foot depth when the Clarendon gage is at or above 12 feet. At stages less than 12 feet at

Clarendon, a minimum depth of five feet is provided. From mile 198 to mile 254 (Newport), a minimum channel width of 100 feet and a depth of four-and-one-half feet are provided. The lower ten miles of the White River are part of the McClellan Kerr Arkansas River Navigation System, which provides for a 300-foot wide channel with a minimum depth of nine feet.

Current maintenance on the White River occurs annually from July through October. Generally, 25 to 30 locations on 244 miles of river are dredged for an average length of 2000-3000 feet. On the Mississippi River, required dredging to maintain channel dimensions is estimated through correlation to a *"Low Water Reference Plane"*. The White River has no official *"Low Water Reference Plane"*. Instead, a *"maintenance profile"* guides current Corps of Engineers operation and maintenance efforts on the White River. The "maintenance profile" aids in determining where dredging is needed and the depth of shoals to be removed. Shoaling in the White River generally occurs in the same reaches year after year, so the depth of annual shoal removal required to maintain the navigation project has been estimated from past dredging experience. The Corps of Engineers states that shoaling occurs throughout the year immediately following dredging. In specific areas with a history of above-average shoaling, the Corps dredges deeper than the required minimum depth in an effort to maintain project navigation depths year-round. Those areas subject to above average shoaling undoubtedly do not support the minimum depths year-round every year. Estimated water depths as related to stage-discharge data are displayed in Appendix A.

Observed Navigation Requirements

Towing company correspondence indicates that they "focus on historic gage readings as the practical and objective criterion for river flows that support navigation." Gage observations are made by grain elevator managers, whose facilities are located close to various gage locations along the White River. Bunge Corporation reports that their barges can be loaded to a 10-foot draft. Shipping is not considered economically feasible for Bunge Corporation unless their barges are loaded to at least an 8-foot draft (tugboat engines require a minimum 7 feet depth to operate). Below are gage readings that Bunge Corporation considers adequate to transport goods on the White River. Tables 12 and 13, Pages 45 & 46, reflect shipments of various commodities on the White River reported to the Corps of Engineers.

Observed Navigation Requirements on the White River

(Source: Bunge Corp.)

Gage Location	Gage Reading	CFS	Exceedence
St. Charles	13	15,159	68.7%
Clarendon	16	17,500	60.4%
Des Arc	9	15,618	61.1%
Augusta	18	14,968	57.1%
Newport	11	23,660	35.3%

Table 11. Gage readings and corresponding flow on the White River deemed necessary for barge movement by the Bunge Corporation.

WHITE RIVER, ARKANSAS
Total Tonnage (1982-1993)
(Short Tons- 2,000 lbs. per ton)
TOTALS

Month	1982	1983	1984	1985	1986	1987
January	66,910	97,597	135,996	89,330	104,319	7,638
February	139,813	76,625	116,347	127,334	45,357	64,416
March	75,688	64,136	52,758	62,018	67,887	138,476
April	82,974	38,814	28,164	37,788	28,087	43,399
May	42,075	16,945	15,902	38,953	18,582	28,341
June	137,975	63,582	124,033	60,730	92,374	49,520
July	41,084	46,190	39,268	25,487	68,270	32,897
August	1,427	21,498	4,534	28,751	17,211	19,058
September	1,419	16,198	13,121	40,525	4,112	11,200
October	1,456	0	35,932	37,355	0	6,375
November	10,892	6,302	59,428	31,370	10,851	10,304
December	58,108	71,973	48,504	73,032	47,042	24,568
TOTAL	659,821	519,800	667,987	652,673	504,092	436,192

Month	1988	1989	1990	1991	1992	1993
January	104,899	111,467	3,065	59,683	88,251	136,079
February	116,134	79,839	137,348	108,437	60,405	112,099
March	68,326	78,353	159,786	137,787	66,376	70,795
April	41,322	48,013	52,393	30,397	30,784	15,391
May	24,502	28,537	17,876	23,665	17,012	19,710
June	7,832	51,161	63,719	35,027	67,335	102,561
July	7,055	70,546	36,314	65,127	118,236	69,022
August	10,411	14,701	12,422	24,823	21,969	5,294
September	0	0	13,948	14,667	0	0
October	2,344	959	13,230	11,197	0	14,754
November	25,400	850	3,595	29,920	1,429	61,802
December	95,468	0	31,953	59,935	37,858	65,485
TOTAL	503,693	484,426	545,649	600,665	509,655	672,992

Month	TOTAL	AVERAGE
January	1,005,234	83,770
February	1,184,154	98,680
March	1,042,386	86,866
April	477,526	39,794
May	292,100	24,342
June	855,849	71,321
July	613,496	51,125
August	182,099	15,175
September	115,190	9,599
October	123,602	10,300
November	252,143	21,012
December	613,866	51,156
TOTAL	6,757,645	563,140

Table 12. Total traffic on the White River (Tables 1982-1993).

Average Tonnage Shipped

White River, Arkansas

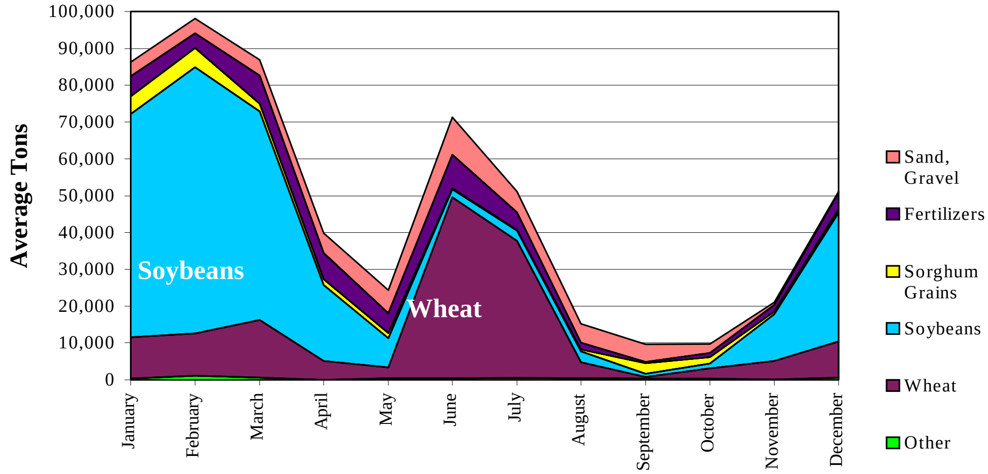


Figure 20. Average monthly commodity tonnage, which was shipped on the White River between the years 1982-1993. Soybeans and wheat were the main commodities shipped during the period of record. Soybeans are typically shipped during the October through April months. Wheat is typically shipped year-round, with most shipments occurring during the months of May through August.

Annual Traffic Volume

White River, Arkansas

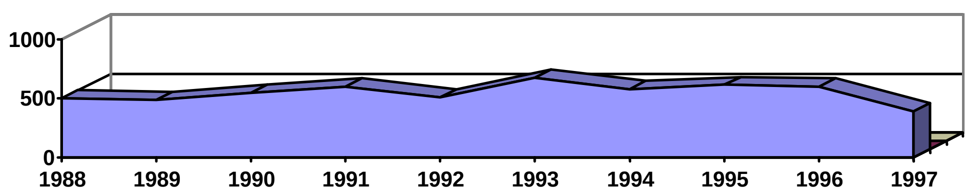


Figure 21. Annual freight traffic, in thousand short tons, which was shipped on the White River between 1988 and 1997.

Commodities Shipped on the White River

(1982-1993)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wheat	134,957	137,942	188,522	60,634	36,273	590,132	446,326	52,781	6,186	33,935	59,228	117,975
Soybeans	727,481	867,844	679,333	248,220	94,596	26,147	34,029	35,601	9,645	14,654	152,184	419,458
Sorghum Grain	57,882	61,280	24,967	19,101	17,553	2,844	1,675	6,263	35,205	21,647	9,046	12,061
Fertilizer	65,395	49,002	91,906	85,696	64,091	109,694	57,475	21,234	3,810	13,665	22,199	53,426
Sand, Gravel	46,839	47,564	50,899	63,875	75,168	122,187	67,805	61,990	57,217	29,331	8,100	3,700
Other	3,341	13,522	6,812	0	4,419	4,855	6,186	4,230	3,127	3,360	1,386	7,246

Table 13. Information contained in this table was used to develop the graph in Figure 20.

The data presented in tables 12 and 13 gives a history of the types of shipments made, when they occur, and how much is shipped. The timeframe for which movement occurs will provide an insight as to how and when the navigation interests may be affected during a low water event.

The White River Valley Association, in conjunction with the private sector, has submitted material on the quantity and types of shipments made on the White River. The Workgroup has also speculated on the future growth of waterborne commerce on the White River if a nine-foot channel was to be maintained. The nine-foot channel project, re-authorized in 1996, would provide a nine-foot channel up to Newport. The Workgroup projects that tonnage would increase by more than 600 percent (see table 14, page 47). The current authorized dredging project provides the basis from which this report was founded.

White River Navigation Needs

(Source: White River Navigation Needs Work Group)

Commodity	Tonnage		
	Existing Traffic	Outbound	with Nine Foot Channel
Grain	666,000		810,000
Fly Ash	0		200,000
Steel Finished Products	0		160,000
Crushed Rock	0		1,750,000
Silica	0		100,000
Limestone	0		500,000
Wood Chips	0		800,000
Poultry Products	0	Inbound	N/A
Fertilizer	68,000		205,000
Corn Feed	25,000		636,000
Scrap Metal	0		120,000
Fuel Oil	0		N/A
Sand and Gravel	75,000		75,000
Other	0		N/A
Totals	**834,000**		**5,356,000**

Table 14. The Navigation Work Group has projected these shipments on the White River with a nine-foot channel.

ALLOCATION ANALYSIS

“IN-STREAM” FLOW DETERMINATIONS

Data Acquisition: The White River waterways system in Arkansas provides numerous resource benefits to many interests, including both governmental and private entities. Commercial and recreational fishing, general recreation, navigation and transportation, groundwater recharge, water quality, municipal and industrial, and wildlife uses include multi-agency responsibilities. The Commission conducted open discussions with affected interests concerning the establishment of allocation and “shut-off” levels for the White River below Bull Shoals.

To maximize involvement of affected persons, including state and private entities, the Commission held independent “workgroup meetings” to solicit input on fish and wildlife, recreation, navigation, water quality, aquifer recharge, agricultural, and municipal and industrial uses and needs. Constituent concerns were discussed, and information on current and potential flow requirements was submitted. A workgroup of fisheries, recreational, and biological scientists representing Arkansas’ Game & Fish Commission, Department of Parks and Tourism, Natural Heritage Commission, Scenic Rivers Commission, Department of Environmental Quality, Soil & Water Conservation Commission, and the U.S. Fish & Wildlife Service was formed. This workgroup consolidated fish and wildlife concerns and provided recommendations to Commission staff. The fish and wildlife workgroup met regularly for over a year, incorporating surveys and fieldwork to formulate recommended fish and wildlife flow requirements. Similarly, navigation interests met with Commission staff in Newport and Little Rock to provide information concerning navigation and economic impacts associated with low flow conditions on the White River.

Data contained in the previous section entitled *“In-Stream Flow Needs”* (page 28), represents information and recommendations obtained during these workgroup meetings and submitted to the Commission. Discharge and stage recommendations from these workgroups represents desired allocation and minimum flow values based on their most current research and field observations.

Seasonal Variation: Varying stream demands and uses throughout the year necessitated analyses of seasonal allocation components to reflect activities during partial periods of an entire year. The projected critical demand periods of the year coincided with overlap of seasonal demands from out-of-stream and instream uses. For example, the greatest agricultural out-of-stream demand typically occurs between the months of June and September, whereas paddlefish spawning requirements are highest between the months of February and May. Therefore, establishing seasonal allocation levels allows greater flexibility in protecting instream uses, while providing logical guidance for out-of-stream use.

PROPOSED ALLOCATION LEVEL DETERMINATIONS

Shortage Conditions: Establishing benchmark instream flows in the allocation plan requires consideration of impacts associated with restricting out-of-stream uses as well as instream needs. Impacts (economical, frequency of restriction, etc.) from out-of-stream uses must be compared with associated impacts to instream uses and resources during "shortage conditions". Scientific data submitted to the Commission identified optimum flow requirements for individual needs. Maximizing a particular instream resource over another is not consistent with the Commission's interpretation of a shortage condition. (However, provisions for "priority of use" during times of shortage are included in the Commission Rules & Regulations for the use of surface water.) Therefore, allocation levels may vary from workgroup recommendations and represent degraded levels for some uses, consistent with the definition of "shortage conditions".

Period of Record Flow Analyses: Determination of equitable allocation levels requires review and analyses of historical river flows to identify seasonal variations and historical drought occurrences. Evaluation of historical conditions includes review of 1) daily flows - maximum, median, and minimum; 2) exceedence flows; 3) flow recurrence frequencies (frequency of specified flow occurrences; over period of record) and, 4) seasonal flow duration. A comprehensive flow database is a crucial component for modeling different allocation scenarios as related to "real-life" river flow conditions.

Daily flows versus workgroup recommendations are shown in figures 22-24, pages 50 and 51. Comparison of daily flow values and recommended allocation levels indirectly reflect how often allocation might occur. However, knowing how many days a month a particular flow occurs is more useful for evaluating allocation levels and impacts.

"Exceedence flows" indicate the percentage of time during a period of analyses that a specified flow is equaled or exceeded (see Appendix A). While this determination yields a percentage of exceedence throughout the period of record, it does not reflect how often or when during the period of record the specified flow occurs. For purposes of evaluating possible allocation conditions, exceedence flow determinations alone are inadequate to complete allocation level assessments and impacts. Therefore, flow frequency analyses are needed to statistically determine when, how often, and for how long specified flows occur during the period of analyses.

Flow frequency analyses for the Clarendon & Newport gages *(1965-1992**)*** have been completed by the Memphis District Corps of Engineers and are included in this report on pages 17-20. A similar frequency analyses was completed for the DeValls Bluff gage by the U.S. Geological Survey. However, substantial gaps in data existed for the DeValls Bluff gage, so it was not included in this report.

Additional flow frequency and occurrence analyses were completed by Commission staff for Calico Rock, Newport, and Clarendon gages. Tables 15 A - C on pages 53-72 show the number of days that flows were less than any given gage level each month for the period of record. Data for these tables was compiled from published flow records and statistical one-day frequency occurrence events. An example of how to read these tables is shown on page 52. Evaluation of results from the Commission's analyses is included in the following section entitled *"Allocation Scenarios"*.

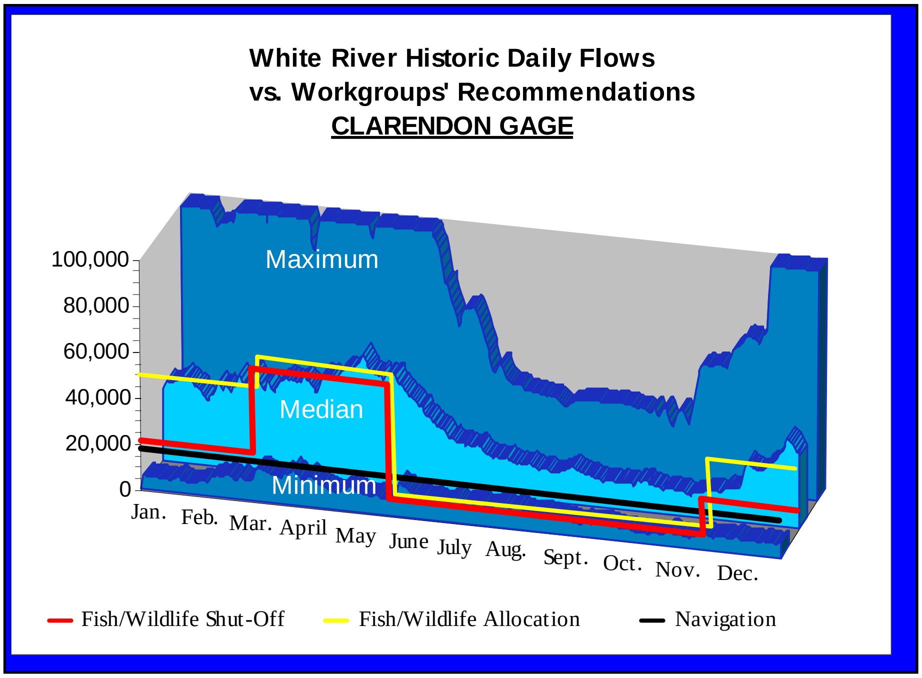


Figure 22. Daily Flows vs. Workgroup Recommendations

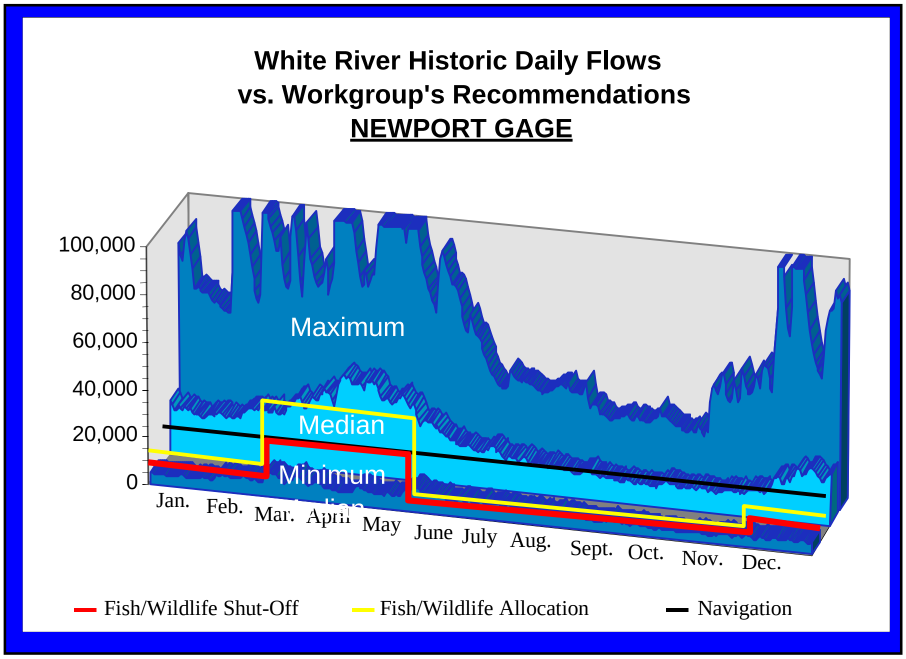


Figure 23. Daily Flows vs. Workgroup Recommendations

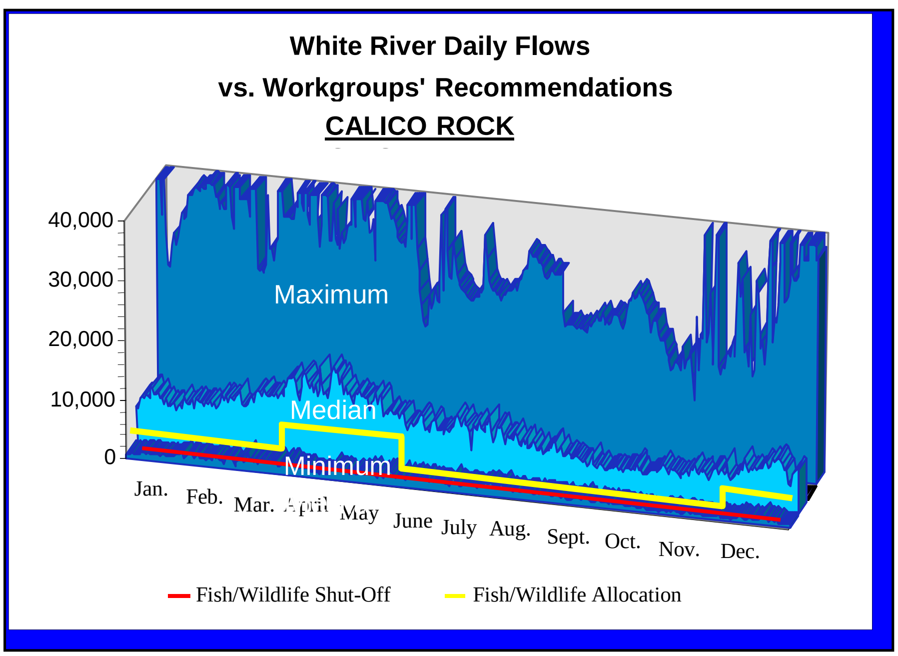


Figure 24. Daily Flows vs. Workgroup Recommendations

FLOW FREQUENCY & DAILY OCCURRENCE TABLES

EXAMPLE: Below is an example of the flow frequency tables on pages 53-74. Notice that numbers listed in the month columns represent days that flow and stage readings were less than corresponding values appearing on the left and right sides of the chart.

Number of days in June 1963, when flow was less than 32,500 cfs and stage reading less than 23 ft.

Month

Year

	1963												1964												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000															15	13									59,000 cfs
26 ft															13	2	31								49,200 cfs
25 ft															12	0	30								41,900 cfs
24 ft			31												11		28								35,900 cfs
23 ft			20			30									10		27								32,500 cfs
22 ft			16		31	25									10		26								29,900 cfs
21 ft			13		30	21									9		22								27,600 cfs
20 ft			10	30	30	18									9		19							31	25,400 cfs
19 ft			8	29	29	17									9		15							24	23,300 cfs
18 ft			8	27	29	16									9		11							19	21,200 cfs
17 ft			7	26	28	5									9		10							15	19,200 cfs
16 ft			6	22	28	4	31								8		5			31		31		12	17,500 cfs
15 ft			6	21	28	0	28								8		4			28	30	30	30	7	15,900 cfs
14 ft			5	19	27		27	31							7		3	30	31	26	30	27	29	4	14,350 cfs
13 ft	31	28	4	17	27		19	27			30				5		0	29	28	22	27	25	22	0	12,850 cfs
12 ft	27	26	2	10	27		13	19			27	31		28	5			23	26	19	22	23	21		11,350 cfs
11 ft	19	12	1	2	16		8	16	30	31	25	29		13	4			8	13	16	17	16	20		9,875 cfs
10 ft	0	2	0	0	10		0	11	27	26	24	19	31	9	0			1	2	1	10	11	19		8,460 cfs
9 ft		0			5			0	11	19	21	8	26	8				0	0	0	1	9	19		7,125 cfs
6800					0				5	17	20	4	23	8							0	3	17		6,800 cfs
8 ft									0	5	5	0	8	1								0	0		5,850 cfs
7 ft										0	0		0	0											4,700 cfs
6 ft																									3,650 cfs

Flow -cubic feet/second

Stage Reading

Table 15 A. Clarendon 1963-1968

1963

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000													59,000 cfs
26 ft													49,200 cfs
25 ft													41,900 cfs
24 ft			31										35,900 cfs
23 ft			20			30							32,500 cfs
22 ft			16		31	25							29,900 cfs
21 ft			13		30	21							27,600 cfs
20 ft			10	30	30	18							25,400 cfs
19 ft			8	29	29	17							23,300 cfs
18 ft			8	27	29	16							21,200 cfs
17 ft			7	26	28	5							19,200 cfs
16 ft			6	22	28	4	31						17,500 cfs
15 ft			6	21	28	0	28						15,900 cfs
14 ft			5	19	27		27	31					14,350 cfs
13 ft	31	28	4	17	27		19	27			30		12,850 cfs
12 ft	27	26	2	10	27		13	19			27	31	11,350 cfs
11 ft	19	12	1	2	16		8	16	30	31	25	29	9,875 cfs
10 ft	0	2	0	0	10		0	11	27	26	24	19	8,460 cfs
9 ft		0			5			0	11	19	21	8	7,125 cfs
6800					0				5	17	20	4	6,800 cfs
8 ft									0	5	5	0	5,850 cfs
7 ft										0	0		4,700 cfs
6 ft													3,650 cfs

1964

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000			15	13									59,000 cfs
26 ft			13	2	31								49,200 cfs
25 ft			12	0	30								41,900 cfs
24 ft			11		28								35,900 cfs
23 ft			10		27								32,500 cfs
22 ft			10		26								29,900 cfs
21 ft			9		22								27,600 cfs
20 ft			9		19							31	25,400 cfs
19 ft			9		15							24	23,300 cfs
18 ft			9		11							19	21,200 cfs
17 ft			9		10							15	19,200 cfs
16 ft			8		5			31		31		12	17,500 cfs
15 ft			8		4			28	30	30	30	7	15,900 cfs
14 ft			7		3	30	31	26	30	27	29	4	14,350 cfs
13 ft			5		0	29	28	22	27	25	22	0	12,850 cfs
12 ft		28	5			23	26	19	22	23	21		11,350 cfs
11 ft		13	4			8	13	16	17	16	20		9,875 cfs
10 ft	31	9	0			1	2	1	10	11	19		8,460 cfs
9 ft	26	8				0	0	0	1	9	19		7,125 cfs
6800	23	8							0	3	17		6,800 cfs
8 ft	8	1								0	0		5,850 cfs
7 ft	0	0											4,700 cfs
6 ft													3,650 cfs

1965

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000		28											59,000 cfs
26 ft	31	23		30									49,200 cfs
25 ft	31	17	31	15									41,900 cfs
24 ft	27	12	25	4					30				35,900 cfs
23 ft	24	11	19	2	31				28	31			32,500 cfs
22 ft	21	11	16	0	30				24	29			29,900 cfs
21 ft	20	10	13		29	30			24	28			27,600 cfs
20 ft	17	10	10		25	29			24	28			25,400 cfs
19 ft	16	10	2		17	25			23	27			23,300 cfs
18 ft	10	10	0		8	21			23	26			21,200 cfs
17 ft	9	5			0	14	31		18	25			19,200 cfs
16 ft	9	3				4	29	31	14	25			17,500 cfs
15 ft	9	0				0	14	28	12	23			15,900 cfs
14 ft	8						5	19	11	21			14,350 cfs
13 ft	3						0	10	10	17		31	12,850 cfs
12 ft	0							3	8	11	30	19	11,350 cfs
11 ft								0	6	3	14	4	9,875 cfs
10 ft									0	0	0	0	8,460 cfs
9 ft													7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1966

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000	17	23	30	29	8								59,000 cfs
26 ft	13	15	22	27	2	30							49,200 cfs
25 ft	9	12	17	25	0	23							41,900 cfs
24 ft	6	5	8	24		18							35,900 cfs
23 ft	5	2	7	23		17		31					32,500 cfs
22 ft	4	0	3	23		16		26					29,900 cfs
21 ft	3		1	22		15		25					27,600 cfs
20 ft	3		0	18		14		22					25,400 cfs
19 ft	3			14		13		20	30				23,300 cfs
18 ft	2			7		11	31	17	26			31	21,200 cfs
17 ft	2			0		7	23	14	21			30	19,200 cfs
16 ft	2					0	16	14	20			29	17,500 cfs
15 ft	2						8	13	18			28	15,900 cfs
14 ft	2						6	12	18	31	30	28	14,350 cfs
13 ft	1						2	2	15	28	28	27	12,850 cfs
12 ft	1						0	0	12	18	21	27	11,350 cfs
11 ft	0								4	11	16	10	9,875 cfs
10 ft									0	3	6	1	8,460 cfs
9 ft										0	0	0	7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1967

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000												31	59,000 cfs
26 ft												22	49,200 cfs
25 ft					31							18	41,900 cfs
24 ft					20	30						15	35,900 cfs
23 ft			31		16	28						14	32,500 cfs
22 ft			29		9	26						13	29,900 cfs
21 ft			25		5	24						12	27,600 cfs
20 ft			23		2	23	31				30	12	25,400 cfs
19 ft	31	28	18		1	22	24	31		31	28	10	23,300 cfs
18 ft	27	24	17	30	1	21	19	28		30	26	2	21,200 cfs
17 ft	22	18	12	29	0	19	15	24		28	25	2	19,200 cfs
16 ft	19	14	10	26		18	13	22		26	24	1	17,500 cfs
15 ft	11	8	6	19		10	6	18		25	17	0	15,900 cfs
14 ft	8	0	6	6		9	2	17		25	7		14,350 cfs
13 ft	0		3	0		5	1	16	30	22	1		12,850 cfs
12 ft			1			2	0	15	29	21	1		11,350 cfs
11 ft			0			0		12	16	13	0		9,875 cfs
10 ft								0	5	4			8,460 cfs
9 ft									0	0			7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1968

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000	31	28	28	9	13	27						29	59,000 cfs
26 ft	19	13	25	0	0	24						22	49,200 cfs
25 ft	13	6	20			21						6	41,900 cfs
24 ft	11	3	14			15						1	35,900 cfs
23 ft	9	2	11			4	31				30	0	32,500 cfs
22 ft	8	1	9			0	30				28		29,900 cfs
21 ft	7	0	7				12				27		27,600 cfs
20 ft	0		5				7		30	31	20		25,400 cfs
19 ft			2				5		29	29	18		23,300 cfs
18 ft			0				3	31	26	28	12		21,200 cfs
17 ft							2	25	24	23	10		19,200 cfs
16 ft							0	16	20	19	8		17,500 cfs
15 ft								8	19	10	6		15,900 cfs
14 ft								3	19	8	2		14,350 cfs
13 ft								0	18	0	0		12,850 cfs
12 ft									16				11,350 cfs
11 ft									10				9,875 cfs
10 ft									0				8,460 cfs
9 ft													7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

Clarendon 1969-1974

1969

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000	0	0	12	0	28								59,000 cfs
26 ft			0		21								49,200 cfs
25 ft					13								41,900 cfs
24 ft					1	30							35,900 cfs
23 ft					0	26							32,500 cfs
22 ft						24							29,900 cfs
21 ft						24							27,600 cfs
20 ft						23							25,400 cfs
19 ft						22							23,300 cfs
18 ft						20							21,200 cfs
17 ft						18						30	19,200 cfs
16 ft						16	31					29	17,500 cfs
15 ft						13	21	31	30			29	15,900 cfs
14 ft						11	12	29	28		30	29	14,350 cfs
13 ft						5	6	13	23	31	25	27	12,850 cfs
12 ft						0	0	8	20	25	23	10	11,350 cfs
11 ft								3	12	8	17	0	9,875 cfs
10 ft								0	0	0	11		8,460 cfs
9 ft											3		7,125 cfs
6800											0		6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1970

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000				30	12								59,000 cfs
26 ft				28	8							31	49,200 cfs
25 ft				26	4							25	41,900 cfs
24 ft	31		31	24	0	30					30	22	35,900 cfs
23 ft	25		20	23		28		31			14	20	32,500 cfs
22 ft	18		8	21		27		28		31	6	17	29,900 cfs
21 ft	14		5	18		25		25	30	28	1	15	27,600 cfs
20 ft	11		4	14		23		23	29	24	0	9	25,400 cfs
19 ft	6		4	11		21		22	27	12		0	23,300 cfs
18 ft	3	28	3	7		19		18	24	7			21,200 cfs
17 ft	3	19	3	0		16	31	14	23	2			19,200 cfs
16 ft	2	8	3			12	29	12	22	0			17,500 cfs
15 ft	1	4	1			5	23	8	21				15,900 cfs
14 ft	0	0	0			0	14	1	7				14,350 cfs
13 ft							9	0	5				12,850 cfs
12 ft							3		0				11,350 cfs
11 ft							0						9,875 cfs
10 ft													8,460 cfs
9 ft													7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1971

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000													59,000 cfs
26 ft	31	28	31									31	49,200 cfs
25 ft	6	15	15									27	41,900 cfs
24 ft	0	0	11									21	35,900 cfs
23 ft			8									19	32,500 cfs
22 ft			6									18	29,900 cfs
21 ft			4									17	27,600 cfs
20 ft			1	30								16	25,400 cfs
19 ft			0	29	31	30						14	23,300 cfs
18 ft				28	27	29						13	21,200 cfs
17 ft				27	18	27						12	19,200 cfs
16 ft				26	12	19		31		31		11	17,500 cfs
15 ft				22	8	18		27		29		11	15,900 cfs
14 ft				16	2	14	31	14	30	26		10	14,350 cfs
13 ft				2	0	4	30	4	27	24	30	10	12,850 cfs
12 ft				0		0	21	2	23	24	28	9	11,350 cfs
11 ft							8	0	17	21	23	9	9,875 cfs
10 ft							0		4	15	18	9	8,460 cfs
9 ft									0	8	12	8	7,125 cfs
6800										5	11	4	6,800 cfs
8 ft										0	2	0	5,850 cfs
7 ft											0		4,700 cfs
6 ft													3,650 cfs

1972

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000					31						11	31	59,000 cfs
26 ft					23						8	9	49,200 cfs
25 ft				30	14						6	3	41,900 cfs
24 ft				29	7						4	0	35,900 cfs
23 ft				26	6						3		32,500 cfs
22 ft				24	5						2		29,900 cfs
21 ft	31			23	3						2		27,600 cfs
20 ft	29			22	2						2		25,400 cfs
19 ft	18			21	1						1		23,300 cfs
18 ft	16			19	0	30					1		21,200 cfs
17 ft	12		31	15		29				31	0		19,200 cfs
16 ft	10		29	0		28	31	31		27			17,500 cfs
15 ft	9	28	28			23	26	24	30	16			15,900 cfs
14 ft	7	26	26			16	15	19	28	7			14,350 cfs
13 ft	5	11	8			15	5	9	22	2			12,850 cfs
12 ft	0	3	2			7	0	3	18	0			11,350 cfs
11 ft		0	0			0		2	13				9,875 cfs
10 ft								0	3				8,460 cfs
9 ft									0				7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1973

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000	31	0	14	0	0	20					30	1	59,000 cfs
26 ft	21		2			13					29	0	49,200 cfs
25 ft	0		0			7	31				28		41,900 cfs
24 ft						0	29	31	30		27		35,900 cfs
23 ft							0	10	7		26		32,500 cfs
22 ft								0	4		25		29,900 cfs
21 ft									1	31	25		27,600 cfs
20 ft									0	30	25		25,400 cfs
19 ft										28	24		23,300 cfs
18 ft										22	24		21,200 cfs
17 ft										17	23		19,200 cfs
16 ft										10	21		17,500 cfs
15 ft										6	5		15,900 cfs
14 ft										0	1		14,350 cfs
13 ft											0		12,850 cfs
12 ft													11,350 cfs
11 ft													9,875 cfs
10 ft													8,460 cfs
9 ft													7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1974

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000	12	1	17	23	28	16							59,000 cfs
26 ft	0	0	0	12	16	10							49,200 cfs
25 ft				0	0	1	31				30	31	41,900 cfs
24 ft						0	29				28	27	35,900 cfs
23 ft							25				25	12	32,500 cfs
22 ft							22				13	6	29,900 cfs
21 ft							4	31	30		9	0	27,600 cfs
20 ft							4	26	22		8		25,400 cfs
19 ft							1	11	15	31	7		23,300 cfs
18 ft							0	0	11	27	6		21,200 cfs
17 ft									4	14	5		19,200 cfs
16 ft									2	12	4		17,500 cfs
15 ft									0	7	3		15,900 cfs
14 ft										3	2		14,350 cfs
13 ft										0	0		12,850 cfs
12 ft													11,350 cfs
11 ft													9,875 cfs
10 ft													8,460 cfs
9 ft													7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

Clarendon 1975-1980

1975

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000	18	22	9	0	11								59,000 cfs
26 ft	10	7	2		7								49,200 cfs
25 ft	5	0	0		4								41,900 cfs
24 ft	2				2	30							35,900 cfs
23 ft	0				0	29							32,500 cfs
22 ft						26							29,900 cfs
21 ft						25						31	27,600 cfs
20 ft						23			30			22	25,400 cfs
19 ft						20	31	31	25			14	23,300 cfs
18 ft						11	28	27	22	31		11	21,200 cfs
17 ft						6	27	23	20	29		9	19,200 cfs
16 ft						0	25	15	14	26		8	17,500 cfs
15 ft							19	10	10	25	30	7	15,900 cfs
14 ft							10	3	4	17	27	5	14,350 cfs
13 ft							3	0	1	11	15	0	12,850 cfs
12 ft							0		0	1	2		11,350 cfs
11 ft										0	0		9,875 cfs
10 ft													8,460 cfs
9 ft													7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1976

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000													59,000 cfs
26 ft							31						49,200 cfs
25 ft		28				30	26						41,900 cfs
24 ft	31	25				28	15						35,900 cfs
23 ft	25	22	31		31	27	13						32,500 cfs
22 ft	21	21	29	30	28	26	11						29,900 cfs
21 ft	16	20	21	25	26	24	6	31					27,600 cfs
20 ft	12	18	18	18	25	20	0	27					25,400 cfs
19 ft	8	16	13	14	23	9		20					23,300 cfs
18 ft	5	15	6	11	21	4		17					21,200 cfs
17 ft	0	8	1	9	19	0		16					19,200 cfs
16 ft		6	0	1	13			14		31			17,500 cfs
15 ft		4		0	9			9	30	24	30		15,900 cfs
14 ft		0			0			0	29	16	27		14,350 cfs
13 ft									21	12	15		12,850 cfs
12 ft									9	4	10	31	11,350 cfs
11 ft									3	0	8	22	9,875 cfs
10 ft									0		5	11	8,460 cfs
9 ft											0	3	7,125 cfs
6800												2	6,800 cfs
8 ft												0	5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1977

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000				17									59,000 cfs
26 ft				13									49,200 cfs
25 ft			31	9								31	41,900 cfs
24 ft			30	5						31	30	16	35,900 cfs
23 ft			26	1	31					28	30	8	32,500 cfs
22 ft			16	0	30					25	26	1	29,900 cfs
21 ft			12		29					23	23	0	27,600 cfs
20 ft			10		26				30	22	16		25,400 cfs
19 ft			8		21				29	21	11		23,300 cfs
18 ft			5		19				28	20	6		21,200 cfs
17 ft	31		4		15	30	31		26	19	5		19,200 cfs
16 ft	28		4		7	28	30		25	16	4		17,500 cfs
15 ft	21	28	4		4	28	28		25	13	4		15,900 cfs
14 ft	19	26	3		0	27	27	31	24	3	3		14,350 cfs
13 ft	17	19	0			26	24	27	18	0	2		12,850 cfs
12 ft	11	7				24	15	22	2		0		11,350 cfs
11 ft	9	2				16	1	17	0				9,875 cfs
10 ft	6	0				4	0	11					8,460 cfs
9 ft	3					0		0					7,125 cfs
6800	3												6,800 cfs
8 ft	0												5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1978

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000			31	30	31							20	59,000 cfs
26 ft			20	0	14							15	49,200 cfs
25 ft	31	28	10		5	30						12	41,900 cfs
24 ft	25	26	6		0	26						8	35,900 cfs
23 ft	20	24	5			23						5	32,500 cfs
22 ft	16	22	4			16						3	29,900 cfs
21 ft	13	21	3			15						2	27,600 cfs
20 ft	9	9	0			14					30	0	25,400 cfs
19 ft	0	4				13					29		23,300 cfs
18 ft		0				12					22		21,200 cfs
17 ft						11	31		30		19		19,200 cfs
16 ft						9	25		21		18		17,500 cfs
15 ft						8	17	31	7		18		15,900 cfs
14 ft						0	11	29	2		17		14,350 cfs
13 ft							3	27	1	31	13		12,850 cfs
12 ft							1	23	0	29	12		11,350 cfs
11 ft							0	14		23	11		9,875 cfs
10 ft								6		19	4		8,460 cfs
9 ft								0		5	0		7,125 cfs
6800										2			6,800 cfs
8 ft										0			5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1979

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000			4	0	0	21							59,000 cfs
26 ft	31	28	1			17							49,200 cfs
25 ft	17	26	0			13							41,900 cfs
24 ft	6	19				4	31						35,900 cfs
23 ft	1	16				0	30					31	32,500 cfs
22 ft	0	14					26	31	30			30	29,900 cfs
21 ft		13					0	17	24			28	27,600 cfs
20 ft		8						0	21			27	25,400 cfs
19 ft		3							19			26	23,300 cfs
18 ft		0							17	31		25	21,200 cfs
17 ft									12	26	30	23	19,200 cfs
16 ft									6	20	28	21	17,500 cfs
15 ft									3	5	16	8	15,900 cfs
14 ft									2	3	4	1	14,350 cfs
13 ft									0	0	0	0	12,850 cfs
12 ft													11,350 cfs
11 ft													9,875 cfs
10 ft													8,460 cfs
9 ft													7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1980

	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000				30									59,000 cfs
26 ft				26									49,200 cfs
25 ft			31	19									41,900 cfs
24 ft			28	12									35,900 cfs
23 ft			20	0	31								32,500 cfs
22 ft	31		19		29								29,900 cfs
21 ft	28		18		27								27,600 cfs
20 ft	16	28	17		14	30							25,400 cfs
19 ft	12	25	16		10	29							23,300 cfs
18 ft	7	22	16		8	23							21,200 cfs
17 ft	5	19	9		6	19	31						19,200 cfs
16 ft	3	16	0		3	17	28					31	17,500 cfs
15 ft	2	9			0	13	21				30	27	15,900 cfs
14 ft	0	0				9	14				26	24	14,350 cfs
13 ft						0	7	31			22	19	12,850 cfs
12 ft							6	26	30		17	9	11,350 cfs
11 ft							5	13	29	31	15	2	9,875 cfs
10 ft							0	5	22	23	4	0	8,460 cfs
9 ft								0	12	9	0		7,125 cfs
6800									9	8			6,800 cfs
8 ft									0	5			5,850 cfs
7 ft										0			4,700 cfs
6 ft													3,650 cfs

Clarendon 1981-1986

1981

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000													59,000 cfs
26 ft													49,200 cfs
25 ft													41,900 cfs
24 ft													35,900 cfs
23 ft						30							32,500 cfs
22 ft						22							29,900 cfs
21 ft					31	13							27,600 cfs
20 ft					28	10							25,400 cfs
19 ft					27	8							23,300 cfs
18 ft		28	31		27	7							21,200 cfs
17 ft		24	25		21	5							19,200 cfs
16 ft		22	21		19	3							17,500 cfs
15 ft		21	16		17	1		31					15,900 cfs
14 ft		19	9	30	17	0	31	23	30				14,350 cfs
13 ft		11	4	26	16		26	21	24		30		12,850 cfs
12 ft	31	10	0	22	15		15	17	22		28		11,350 cfs
11 ft	24	4		12	12		5	3	20		20		9,875 cfs
10 ft	19	3		6	7		0	0	13	31	14	31	8,460 cfs
9 ft	9	1		0	0				9	27	7	21	7,125 cfs
6800	6	0							9	23	4	15	6,800 cfs
8 ft	0								5	18	0	0	5,850 cfs
7 ft									0	10			4,700 cfs
6 ft										0			3,650 cfs

1982

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000		9	27									8	59,000 cfs
26 ft		5	21									7	49,200 cfs
25 ft		3	18	30								5	41,900 cfs
24 ft	31	0	0	26	31							3	35,900 cfs
23 ft	30			22	30							2	32,500 cfs
22 ft	27			9	24							1	29,900 cfs
21 ft	26			0	20		31				30	0	27,600 cfs
20 ft	25				17	30	25				29		25,400 cfs
19 ft	24				15	28	24				29		23,300 cfs
18 ft	24				13	17	22	31	30		29		21,200 cfs
17 ft	24				5	13	20	28	27		28		19,200 cfs
16 ft	23				0	11	19	25	25		28		17,500 cfs
15 ft	21					9	18	22	22	31	27		15,900 cfs
14 ft	19					7	17	19	17	28	27		14,350 cfs
13 ft	13					0	6	14	14	26	13		12,850 cfs
12 ft	7						2	8	3	23	9		11,350 cfs
11 ft	5						0	0	0	16	4		9,875 cfs
10 ft	3									5	1		8,460 cfs
9 ft	0									0	0		7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1983

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000	7	26		24	0	28						31	59,000 cfs
26 ft	0	7	31	16		25						12	49,200 cfs
25 ft		0	30	10		22						5	41,900 cfs
24 ft			27	7		18						3	35,900 cfs
23 ft			16	6		14						3	32,500 cfs
22 ft			13	5		8					30	2	29,900 cfs
21 ft			10	5		5	31				29	0	27,600 cfs
20 ft			0	0		2	23	31			27		25,400 cfs
19 ft						0	9	28			26		23,300 cfs
18 ft							5	27			25		21,200 cfs
17 ft							2	25	30		24		19,200 cfs
16 ft							0	21	28		24		17,500 cfs
15 ft								15	26		23		15,900 cfs
14 ft								9	21		23		14,350 cfs
13 ft								4	18		23		12,850 cfs
12 ft								0	13		22		11,350 cfs
11 ft									8	31	20		9,875 cfs
10 ft									2	28	11		8,460 cfs
9 ft									0	12	9		7,125 cfs
6800										7	8		6,800 cfs
8 ft										0	0		5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1984

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000				9	8					31	30	2	59,000 cfs
26 ft	31		31	1	2					23	14	0	49,200 cfs
25 ft	29		19	0	0	30				22	8		41,900 cfs
24 ft	26		6			27				20	0		35,900 cfs
23 ft	25	28	4			25				20			32,500 cfs
22 ft	23	23	2			22				19			29,900 cfs
21 ft	22	19	1			21				19			27,600 cfs
20 ft	19	14	0			19				18			25,400 cfs
19 ft	14	13				17				17			23,300 cfs
18 ft	8	12				13				16			21,200 cfs
17 ft	2	7				12			30	14			19,200 cfs
16 ft	0	5				11		31	29	13			17,500 cfs
15 ft		0				9	31	26	22	13			15,900 cfs
14 ft						1	23	17	18	7			14,350 cfs
13 ft						0	11	7	9	0			12,850 cfs
12 ft							5	3	4				11,350 cfs
11 ft							0	0	0				9,875 cfs
10 ft													8,460 cfs
9 ft													7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1985

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000	0	0	0	0	20							13	59,000 cfs
26 ft					13							3	49,200 cfs
25 ft					8						30	0	41,900 cfs
24 ft					1	30		31			28		35,900 cfs
23 ft					0	6	31	29	30		27		32,500 cfs
22 ft						0	10	5	28		24		29,900 cfs
21 ft							0	0	23		23		27,600 cfs
20 ft									17		23		25,400 cfs
19 ft									9	31	22		23,300 cfs
18 ft									4	29	22		21,200 cfs
17 ft									1	21	21		19,200 cfs
16 ft									0	17	21		17,500 cfs
15 ft										12	20		15,900 cfs
14 ft										6	19		14,350 cfs
13 ft										2	15		12,850 cfs
12 ft										0	2		11,350 cfs
11 ft											0		9,875 cfs
10 ft													8,460 cfs
9 ft													7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

1986

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000	31												59,000 cfs
26 ft	23			30	31								49,200 cfs
25 ft	16		31	19	22								41,900 cfs
24 ft	13		29	11	18	30							35,900 cfs
23 ft	12		21	10	16	23							32,500 cfs
22 ft	10	28	17	8	13	18							29,900 cfs
21 ft	9	25	16	8	0	13						31	27,600 cfs
20 ft	8	10	9	7		3						28	25,400 cfs
19 ft	7	4	0	6		0	31					25	23,300 cfs
18 ft	2	3		4			29	31			30	21	21,200 cfs
17 ft	0	0		3			27	28			27	18	19,200 cfs
16 ft				0			26	25			26	14	17,500 cfs
15 ft							21	18	30		24	13	15,900 cfs
14 ft							14	12	25		19	9	14,350 cfs
13 ft							3	2	18	31	10	5	12,850 cfs
12 ft							0	0	9	18	5	1	11,350 cfs
11 ft									2	10	2	0	9,875 cfs
10 ft									0	0	0		8,460 cfs
9 ft													7,125 cfs
6800													6,800 cfs
8 ft													5,850 cfs
7 ft													4,700 cfs
6 ft													3,650 cfs

Clarendon 1987-1992

	1987												1988												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000			31	30								26	0	11	31	16	28						26	21	59,000 cfs
26 ft			5	24								25		5	15	0	23						24	18	49,200 cfs
25 ft			2	20								24		0	7		21						22	16	41,900 cfs
24 ft			0	18								21			0		19						21	14	35,900 cfs
23 ft		28		16								19					18						20	12	32,500 cfs
22 ft		21		14							30	18					17						20	10	29,900 cfs
21 ft		20		8							27	12					16						20	8	27,600 cfs
20 ft		19		5							27	9					15						20	6	25,400 cfs
19 ft		18		3							26	9					14						20	5	23,300 cfs
18 ft		18		1	31						22	7					11						20	3	21,200 cfs
17 ft		17		0	29	30					20	5					9						20	1	19,200 cfs
16 ft		17			22	27					18	3					6						20	0	17,500 cfs
15 ft		16			11	24					17	0					4	30	31	31			19		15,900 cfs
14 ft	31	11			0	23	31				17						2	25	25	29	30		19		14,350 cfs
13 ft	30	10				18	22	31			16						0	14	17	18	30	31	19		12,850 cfs
12 ft	26	3				7	14	28			16							8	13	10	27	24	15		11,350 cfs
11 ft	20	0				0	2	19			15							0	10	5	15	7	12		9,875 cfs
10 ft	0						0	14	30	31	15								0	0	7	0	7		8,460 cfs
9 ft								3	28	30	14										1		0		7,125 cfs
6800								3	25	28	14										0				6,800 cfs
8 ft								0	6	22	13														5,850 cfs
7 ft									0	4	4														4,700 cfs
6 ft										0	0														3,650 cfs

	1989												1990												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000	31	10	0	0	28									28	6	0	9	30						28	59,000 cfs
26 ft	31	5			20									9	0		0	19						26	49,200 cfs
25 ft	24	3			14	30								5				15						24	41,900 cfs
24 ft	14	0			11	26								5				12				31		22	35,900 cfs
23 ft	1				6	23								5				1	31			27		21	32,500 cfs
22 ft	0				3	16	31							5				0	19			25		21	29,900 cfs
21 ft					0	8	28						31	2					10	31	30	22		20	27,600 cfs
20 ft						2	25						25	1					0	27	20	19		20	25,400 cfs
19 ft						0	24						22	0						0	13	17		17	23,300 cfs
18 ft							13						22								12	16		12	21,200 cfs
17 ft							12						22								11	9		8	19,200 cfs
16 ft							11						22								10	2		6	17,500 cfs
15 ft							11	31					22								3	1	30	4	15,900 cfs
14 ft							10	28					21								0	0	29	0	14,350 cfs
13 ft							5	23	30	31			21										23		12,850 cfs
12 ft							0	20	22	25	30		21										8		11,350 cfs
11 ft								14	12	15	25		20										1		9,875 cfs
10 ft								4	4	6	16		19										0		8,460 cfs
9 ft								0	0	0	3	31	19												7,125 cfs
6800											1	27	19												6,800 cfs
8 ft											0	7	14												5,850 cfs
7 ft												0	0												4,700 cfs
6 ft																									3,650 cfs

	1991												1992												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
59000	0	15		15	12							12	31												59,000 cfs
26 ft		11		12	7						30	0	23		31									31	49,200 cfs
25 ft		5		9	0	30					21		19		25									25	41,900 cfs
24 ft		1	31	3		25					13		12		13	30	31							22	35,900 cfs
23 ft		0	29	0		23					8		8	28	9	29	26							19	32,500 cfs
22 ft			24			20	31				1		6	23	6	25	24							13	29,900 cfs
21 ft			21			5	26				1		5	21	0	21	22	30	31				30	0	27,600 cfs
20 ft			17			0	12				0		3	19		16	21	21	19				27		25,400 cfs
19 ft			13				10						2	18		14	20	14	8				25		23,300 cfs
18 ft			9				9						0	17		13	19	8	7	31			25		21,200 cfs
17 ft			5				7							13		11	18	7	5	29			24		19,200 cfs
16 ft			3				5							8		9	17	6	3	24			24		17,500 cfs
15 ft			0				4							0		5	11	4	0	14		31	23		15,900 cfs
14 ft							2	31	30							0	0	0		12	30	29	18		14,350 cfs
13 ft							0	23	18	30										10	16	23	16		12,850 cfs
12 ft								12	10	29										2	5	9	6		11,350 cfs
11 ft								5	8	29										0	2	3	3		9,875 cfs
10 ft								0	7	17											0	0	0		8,460 cfs
9 ft									3	4															7,125 cfs
6800									0	0															6,800 cfs
8 ft																									5,850 cfs
7 ft																									4,700 cfs
6 ft																									3,650 cfs

Clarendon 1993-1997

1993

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000 ft	11	16	31	28	23						30	12	59,000
26 ft		8	17	19	6						28		49,200
25 ft					2	30					23		41,900
24 ft						27					20		35,900
23 ft						24					18		32,500
22 ft						20					17		29,900
21 ft						12				31	15		27,600
20 ft						2	31			9	8		25,400
19 ft							20	31	30				23,300
18 ft							3	28					21,200
17 ft								25	28				19,200
16 ft								18	27				17,500
15 ft								12	26				15,900
14 ft								5	21				14,350
13 ft									18				12,850
12 ft									13				11,350
11 ft													9,875
9650 ft													9,650
10 ft													8,460
9 ft													7,125
6800 ft													6,800
8 ft													5,850
7 ft													4,700
6 ft													3,650

1994

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000 ft	31	15	3	7								24	59,000
26 ft	18				31							16	49,200
25 ft	7				15						30	12	41,900
24 ft					8						17	4	35,900
23 ft					6						13		32,500
22 ft					3	30	31				11		29,900
21 ft						11	7	31			10		27,600
20 ft						3	2	27			9		25,400
19 ft						1		21					23,300
18 ft								20			8		21,200
17 ft								18	30				19,200
16 ft								13	28				17,500
15 ft								5	26				15,900
14 ft									17	31	7		14,350
13 ft									12	30			12,850
12 ft									3	23			11,350
11 ft									1	7	6		9,875
9650 ft									1	6	6		9,650
10 ft											3		8,460
9 ft													7,125
6800 ft													6,800
8 ft													5,850
7 ft													4,700
6 ft													3,650

1995

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000 ft	30	26			31								59,000
26 ft	23	18	31		22								49,200
25 ft	19	14	21	30	14								41,900
24 ft	16	11	10	26	7	30							35,900
23 ft	14	4	7	17	1	26							32,500
22 ft	8		3	6		7	31	31					29,900
21 ft	6			4			20	25					27,600
20 ft	3			1				6	30			31	25,400
19 ft								3	30			30	23,300
18 ft									27			26	21,200
17 ft									26			24	19,200
16 ft									25			23	17,500
15 ft									24	31	30	22	15,900
14 ft									15	30	28		14,350
13 ft									4	25	22	20	12,850
12 ft									1	19	8	16	11,350
11 ft										12	4	10	9,875
9650 ft										11	4	9	9,650
10 ft											1	2	8,460
9 ft													7,125
6800 ft													6,800
8 ft													5,850
7 ft													4,700
6 ft													3,650

1996

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000 ft											30	2	59,000
26 ft											29	1	49,200
25 ft											19		41,900
24 ft					31						14		35,900
23 ft				30	13	30					12		32,500
22 ft				28		14					10		29,900
21 ft						12				31	9		27,600
20 ft				26		10				28			25,400
19 ft				25		9				27	4		23,300
18 ft	31	29	31	19		8				25	3		21,200
17 ft	28	23	29	8		3	31		30	23	1		19,200
16 ft	26	20	27	5			30			20			17,500
15 ft	23	18	22			2	29			14			15,900
14 ft	18	11	13				23	30		6			14,350
13 ft	7	2	8		1		21	21	29	2			12,850
12 ft			3			1	15	9	23	1			11,350
11 ft							8						9,875
9650 ft							7	2	13				9,650
10 ft									1				8,460
9 ft													7,125
6800 ft													6,800
8 ft													5,850
7 ft													4,700
6 ft													3,650

1997

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000 ft	21	29	2	4	31								59,000
26 ft	17	28			29								49,200
25 ft	13	9			25								41,900
24 ft	10	5			22								35,900
23 ft	4				19								32,500
22 ft					15	30							29,900
21 ft					11	27							27,600
20 ft					7	19							25,400
19 ft					5	18							23,300
18 ft					2	17	31						21,200
17 ft						4	29	31					19,200
16 ft							19	29	30				17,500
15 ft							2	28	29				15,900
14 ft								22	25			30	14,350
13 ft								7	21	31		28	12,850
12 ft								6	12	20	30	25	11,350
11 ft									4	4	16		9,875
9650 ft								2	3	1	13	23	9,650
10 ft									1		4	13	8,460
9 ft												1	7,125
6800 ft													6,800
8 ft													5,850
7 ft													4,700
6 ft													3,650

1998

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
59000 ft													59,000
26 ft													49,200
25 ft													41,900
24 ft													35,900
23 ft													32,500
22 ft													29,900
21 ft													27,600
20 ft													25,400
19 ft													23,300
18 ft													21,200
17 ft													19,200
16 ft													17,500
15 ft													15,900
14 ft													14,350
13 ft													12,850
12 ft													11,350
11 ft													9,875
9650 ft													9,650
10 ft													8,460
9 ft													7,125
6800 ft													6,800
8 ft													5,850
7 ft													4,700
6 ft													3,650

Table 15 B. Newport 1955-1960

	1955												1956												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft			30											27											52,000 cfs
21 ft			29																						48,500 cfs
20 ft														25											45,500 cfs
19 ft			28		31									24											42,810 cfs
18 ft			27		30									23											40,190 cfs
17 ft			26											21											37,630 cfs
16 ft			25	30	29									18											35,130 cfs
15 ft			23	28	28									15											32,700 cfs
14 ft			22	27	26		31							13											30,340 cfs
13 ft		28	20	27	24	30								11			31								28,050 cfs
12 ft				22	22	28								8			30								25,820 cfs
11 ft				17		26								5	31		29	30							23,660 cfs
10 ft		27	18	10	21	25								3	29		23								21,580 cfs
9 ft	31	26		2	20	18	29								28		20								19,570 cfs
8 ft	30	24			19	10	28								27	30	19	28							17,640 cfs
7 ft	29	22			17	7	25								22	26	15	27							15,780 cfs
6 ft	28	21	17		13		16	31							17	24	9	24	31						14,000 cfs
5 ft	27		5		2		5	30							8	11	4	12	30						12,310 cfs
4 ft	25							27					31	1	1	4	1		22	31				31	10,700 cfs
3 ft	23	20						8	30	31	30		29						8	26	30		30	23	9,173 cfs
2 ft	17	16						2	11	28	29	31	27							11	15	31	21	10	7,740 cfs
1 ft	10	9							2	14	8	10	12							2	6	15	6	2	6,401 cfs
0 ft	4												1								1	8	1		5,161 cfs
(-)1 ft																						1			4,025 cfs

	1957												1958												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft					5	12					25				23	20	14						30		52,000 cfs
21 ft						11									23	15	13						28		48,500 cfs
20 ft						9	31				24				22	11	11								45,500 cfs
19 ft						8	29	31			22				21	9	8			31			26		42,810 cfs
18 ft						6	18	28			21				20	4	7			30			21		40,190 cfs
17 ft				3		4	9	19			16				17	3	5			29			20		37,630 cfs
16 ft								16			14		31		15		3	30					19		35,130 cfs
15 ft								12	30			31			12			20	31	28			18		32,700 cfs
14 ft		28	31					10	21	31		30	27		8				26	27			17		30,340 cfs
13 ft		27	30					6	5	26	13	28	25					16	23	25					28,050 cfs
12 ft	31	23	26							25	12	27	23					14	18	20			16	31	25,820 cfs
11 ft	30	22	24	2						21	11	15	20	28				13		17				30	23,660 cfs
10 ft	27	18	22	1						19	10	8	15	24				4	17	13				25	21,580 cfs
9 ft	24	10	18							18	8	6	8	22	7				14	12				24	19,570 cfs
8 ft	23	3	16							15		4	2		6			1	7	9	30		15	16	17,640 cfs
7 ft		1								13				14	5				1		29			13	15,780 cfs
6 ft										10	7			6	3						22	31		11	14,000 cfs
5 ft										2	2			2							3	25		8	12,310 cfs
4 ft																						17	14	1	10,700 cfs
3 ft	22																					2	12		9,173 cfs
2 ft	18																						2		7,740 cfs
1 ft	6																								6,401 cfs
0 ft																									5,161 cfs
(-)1 ft																									4,025 cfs

	1959												1960												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft																	24								52,000 cfs
21 ft																	23								48,500 cfs
20 ft																	20	30							45,500 cfs
19 ft																	19	29							42,810 cfs
18 ft				30							30	31					16	25							40,190 cfs
17 ft											29	30		28			11	22							37,630 cfs
16 ft												29	31				7								35,130 cfs
15 ft		28	31	29									29	27	31			21							32,700 cfs
14 ft		27	29										26	25	27										30,340 cfs
13 ft		22	27	28		30					28		22	23	24			20							28,050 cfs
12 ft	31	21	24	26								27	19	21	19										25,820 cfs
11 ft	29	20	19	24								24	14	19	10	30		18						31	23,660 cfs
10 ft		14	13	23		29				31	27	18	11	18	8	28	6							30	21,580 cfs
9 ft	27	13	4	16	31	28						15	3	7	5	26		16						27	19,570 cfs
8 ft		9	1	14	29	26				30	25	12		1	1	23		12	31					26	17,640 cfs
7 ft		2		10	25	22				27	24					12	5	11	29					23	15,780 cfs
6 ft	20			7	17	17	31			26	21						4	9	23					20	14,000 cfs
5 ft	14				9	8	28	31		19	17							5	21	31				12	12,310 cfs
4 ft	2				1		23	27	30	15	10	11							10	30	30		30	9	10,700 cfs
3 ft							11	14	20	4	1	6							4	9	24	31	28	6	9,173 cfs
2 ft								2	7	3		2								1	18	29	20	1	7,740 cfs
1 ft																					1	5	7		6,401 cfs
0 ft																									5,161 cfs
(-)1 ft																									4,025 cfs

Newport 1961-1966

1961

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft			31	21	9								52,000 cfs
21 ft			29	11	8								48,500 cfs
20 ft			26	8	5								45,500 cfs
19 ft			17	6		30							42,810 cfs
18 ft			7	5		28							40,190 cfs
17 ft				4		24							37,630 cfs
16 ft				2		20	31						35,130 cfs
15 ft					4	19	24						32,700 cfs
14 ft			6	1	3	6	11	31					30,340 cfs
13 ft					2			23				31	28,050 cfs
12 ft								18				29	25,820 cfs
11 ft			5									26	23,660 cfs
10 ft		28	2									23	21,580 cfs
9 ft		25						16				18	19,570 cfs
8 ft		23						15				12	17,640 cfs
7 ft	31	21						14				10	15,780 cfs
6 ft	30	15						13			30	9	14,000 cfs
5 ft	12	9						12			27		12,310 cfs
4 ft	3	1						11	30		25	8	10,700 cfs
3 ft								6	27	31		2	9,173 cfs
2 ft									23	27	22		7,740 cfs
1 ft										3	1		6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1962

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft			28										52,000 cfs
21 ft			26	30									48,500 cfs
20 ft			24	23									45,500 cfs
19 ft	31	26	21	21									42,810 cfs
18 ft	29		19	15									40,190 cfs
17 ft	24	25	18	12	31								37,630 cfs
16 ft	23	24	13	10	27								35,130 cfs
15 ft		20	12	7	25								32,700 cfs
14 ft		19	8		24								30,340 cfs
13 ft		18	4		22								28,050 cfs
12 ft	22	11	4		21								25,820 cfs
11 ft	20	8	2		19								23,660 cfs
10 ft	16	2	2		17								21,580 cfs
9 ft	15		1		13								19,570 cfs
8 ft	14				11								17,640 cfs
7 ft	9				9		31						15,780 cfs
6 ft	4				4	30	29		30	31			14,000 cfs
5 ft					2	29	26	31	28	29		31	12,310 cfs
4 ft						13	12	24	19	17	30	25	10,700 cfs
3 ft						1	4	15	5	7	29	18	9,173 cfs
2 ft							1	3		3	15	8	7,740 cfs
1 ft											2	1	6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1963

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft													52,000 cfs
21 ft													48,500 cfs
20 ft													45,500 cfs
19 ft													42,810 cfs
18 ft													40,190 cfs
17 ft													37,630 cfs
16 ft													35,130 cfs
15 ft					31								32,700 cfs
14 ft					30								30,340 cfs
13 ft			31		28								28,050 cfs
12 ft			30			30							25,820 cfs
11 ft			27		27	28							23,660 cfs
10 ft			21			25							21,580 cfs
9 ft			14										19,570 cfs
8 ft			12			21							17,640 cfs
7 ft			9			8	31				30		15,780 cfs
6 ft				30		3	28	31			29		14,000 cfs
5 ft	31	28	5	25			22	25			28		12,310 cfs
4 ft	28	24	4	15	26		15	21		31	27	31	10,700 cfs
3 ft	25	17	1	6	21		8	19	30	28	25	26	9,173 cfs
2 ft	8	11		2	16			16	28	22	23	22	7,740 cfs
1 ft					7			5	18	21	17	14	6,401 cfs
0 ft									7	10	7	4	5,161 cfs
(-)1 ft													4,025 cfs

1964

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft			20	27									52,000 cfs
21 ft			19	26									48,500 cfs
20 ft			18	25									45,500 cfs
19 ft			17	24									42,810 cfs
18 ft			16	23									40,190 cfs
17 ft			14	22									37,630 cfs
16 ft			12	18									35,130 cfs
15 ft			11	16	31								32,700 cfs
14 ft				15	30								30,340 cfs
13 ft			10	14	29								28,050 cfs
12 ft			9	12									25,820 cfs
11 ft				11									23,660 cfs
10 ft				9	28								21,580 cfs
9 ft				8	27								19,570 cfs
8 ft				1	25							31	17,640 cfs
7 ft					19								15,780 cfs
6 ft					11			31	30		30	28	14,000 cfs
5 ft					7	30	31	26	28	31	29	24	12,310 cfs
4 ft		28	8		4	28	26	23	24	30	26	20	10,700 cfs
3 ft		26	7			22	20	20	23	29	24	10	9,173 cfs
2 ft	31	21				8	11	13	16	26	21	9	7,740 cfs
1 ft	27	7	4			1	5	5	12	17	18	4	6,401 cfs
0 ft	14	5							4	5	12		5,161 cfs
(-)1 ft													4,025 cfs

1965

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft													52,000 cfs
21 ft				30									48,500 cfs
20 ft													45,500 cfs
19 ft				27									42,810 cfs
18 ft		28		26									40,190 cfs
17 ft		27		23									37,630 cfs
16 ft		26		22					30				35,130 cfs
15 ft													32,700 cfs
14 ft	31	25	31	21									30,340 cfs
13 ft		23	30	18	31				29				28,050 cfs
12 ft	30	21	29	10					27				25,820 cfs
11 ft	29	20	27	6					26				23,660 cfs
10 ft	28	18	25	5	30								21,580 cfs
9 ft	26	17	23	2	23	30			25				19,570 cfs
8 ft	25	13	19		14	29	31	31	23				17,640 cfs
7 ft	24	10	15		7	19	28	30	19	31			15,780 cfs
6 ft	21		7		4	14	27	27	16	30			14,000 cfs
5 ft	18	9	2		1	7	21	22	13	28		31	12,310 cfs
4 ft	8	8				3	9	16	11	25	30	23	10,700 cfs
3 ft	6	5				1	4	12	8	16	24	11	9,173 cfs
2 ft	3	2						8	5	3	6	3	7,740 cfs
1 ft	1							1	4				6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1966

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft	20	21			24								52,000 cfs
21 ft	18	18			22								48,500 cfs
20 ft	17	15											45,500 cfs
19 ft		14		23	18								42,810 cfs
18 ft	16	12			8								40,190 cfs
17 ft	14	11			3								37,630 cfs
16 ft	12	10	31		2								35,130 cfs
15 ft	11		28		1								32,700 cfs
14 ft			21	22		30							30,340 cfs
13 ft	10		17	21		28							28,050 cfs
12 ft			14			23							25,820 cfs
11 ft	9		10	19									23,660 cfs
10 ft	7	9	6	18									21,580 cfs
9 ft	3	8	3	13		21	31						19,570 cfs
8 ft		5		7		19	28	31				31	17,640 cfs
7 ft		3		4		11	22	29	30			30	15,780 cfs
6 ft	1	2		2		3	17	26	29			29	14,000 cfs
5 ft		1					14	24	26	31	30	28	12,310 cfs
4 ft							10	16	23	25	25	27	10,700 cfs
3 ft							4	6	21	19	22	15	9,173 cfs
2 ft								1	11	11	16	5	7,740 cfs
1 ft									4	2	12		6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

Newport 1967-1972

	1967												1968												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft												30		26		30	23							23	52,000 cfs
21 ft												28		20	20	23	19						30		48,500 cfs
20 ft												26		13		10	18						28	21	45,500 cfs
19 ft												23		12		2	17							16	42,810 cfs
18 ft												16	31	11			13							9	40,190 cfs
17 ft					31								28	6			11							3	37,630 cfs
16 ft					30								27	5	19		6							1	35,130 cfs
15 ft					26								24		18		2								32,700 cfs
14 ft					24					31		13	23	4	17			30					27		30,340 cfs
13 ft					23						30		21		16		1	29					26		28,050 cfs
12 ft					20						29	12	17	3	14			19							25,820 cfs
11 ft					19								16	2	12			13	31		30		24		23,660 cfs
10 ft			31		17		31			30	28							2	16		28		17		21,580 cfs
9 ft		28	30		16		28	31			27	11	15	1	10				11	31	27	31	9		19,570 cfs
8 ft		26	28	30	15		26	30		28	26	10	9					1	10	29	25	28	7		17,640 cfs
7 ft	31	23	26	28	7	30	21	28			25	5	5						8	23		27	4		15,780 cfs
6 ft	29	20	19	27		28	14	27		27	24	2	3		9				6	18	23	21	2		14,000 cfs
5 ft	22	14	14	22		26	9	26	30	26	19		1		5				4	15	21	16	1		12,310 cfs
4 ft	12	8	10	9		21	6	23	29	24	9				1				3	11	19	9			10,700 cfs
3 ft	7	1	4	2		14	3	21	27	19	6								1	5	17	2			9,173 cfs
2 ft	5					6	2	16	18	12										1	15				7,740 cfs
1 ft	2							7	10	5											5				6,401 cfs
0 ft								1	4																5,161 cfs
(-)1 ft																									4,025 cfs

	1969												1970												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft	12	9	28	18												22	24								52,000 cfs
21 ft	7		21	6												21	20								48,500 cfs
20 ft			15	2													19								45,500 cfs
19 ft			10	2													17								42,810 cfs
18 ft					31																	31		31	40,190 cfs
17 ft					30												15					30		29	37,630 cfs
16 ft					23																			27	35,130 cfs
15 ft																					30	29		22	32,700 cfs
14 ft					12												14				29		30	18	30,340 cfs
13 ft					5												13				27	27	28	13	28,050 cfs
12 ft						30						31			31		9				25	26	23	10	25,820 cfs
11 ft												30	31		30		4			31	23	24	14	7	23,660 cfs
10 ft						29							29		24		3	30		29	21	19	11	5	21,580 cfs
9 ft						28	31						24		17	19	1	28	31	28	20	16	6	4	19,570 cfs
8 ft						26	30						23		12	16		26	30	26	19	11	1		17,640 cfs
7 ft						24	27	31					18	28	6	13		22	27	22		6			15,780 cfs
6 ft						20	24	28					15	26	3	3		9	23	17	18	2			14,000 cfs
5 ft						15	19	26	30	31	30	29	7	24				1	22	12	14				12,310 cfs
4 ft						8	11	19	28	28	26	24	6	12					16	6	11				10,700 cfs
3 ft							6	12	24	13	20	17	5	6	2				5		5				9,173 cfs
2 ft								4	17	5	12	6		1							2				7,740 cfs
1 ft									5	2	6														6,401 cfs
0 ft																									5,161 cfs
(-)1 ft																									4,025 cfs

	1971												1972												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft												29					31						28		52,000 cfs
21 ft																	28						25		48,500 cfs
20 ft												28					26						19		45,500 cfs
19 ft	31															30	25						15		42,810 cfs
18 ft	22	28	31									27				29	23						12	31	40,190 cfs
17 ft	18	23	29									26				27							8	27	37,630 cfs
16 ft	16	21	27													25	20						7	24	35,130 cfs
15 ft	13	19	26													23	19						6	20	32,700 cfs
14 ft	10		21									24					18						4	15	30,340 cfs
13 ft	7	12	20														17						2	14	28,050 cfs
12 ft	6	11	18									23					16							13	25,820 cfs
11 ft	3	10	14		31								31				13							9	23,660 cfs
10 ft	1	8	12		30							22	30			20								7	21,580 cfs
9 ft		2	9		29	30			30	31		21	28			18	11				30			3	19,570 cfs
8 ft		1			25	28				30		19	27		31	16	10		31	31	29	31		2	17,640 cfs
7 ft			5		20	25		31	29			18	25		30	15	9	30	30	30	28	30			15,780 cfs
6 ft			3	30	14	22	31	30	25	29	30	16	21	28	29	13	6	29		25	24	27			14,000 cfs
5 ft				25	11	15	30	27		28		14	16	27	26	11	2	22	24	20		22			12,310 cfs
4 ft				8	5	10	29	24	24	27	26	11	9	20	19	7		18	16	17	22	12			10,700 cfs
3 ft						3	21	18	21	26	24		2	14	5	1		13	10	12	19	4			9,173 cfs
2 ft							18	15	18	23	22	9		2	1			4	5	6	13	1			7,740 cfs
1 ft							9	6	11	14	19	8								3	8				6,401 cfs
0 ft									4	9	15	6									3				5,161 cfs
(-)1 ft										1	6														4,025 cfs

Newport 1973-1978

	1973												1974												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft	31	24			3							17	30	21	29			25							52,000 cfs
21 ft	30	13	10		2	30						16	23	14	21			24							48,500 cfs
20 ft	27	7				22						13	20	8	11	30		23							45,500 cfs
19 ft	24											5	19	3	3	22	31	22							42,810 cfs
18 ft	21	4	9			21							14		2	11	26	20							40,190 cfs
17 ft	19												6		1	5	9	19					30		37,630 cfs
16 ft	18		8			20					24		1					16						31	35,130 cfs
15 ft	14	3				15	31		30							2	3	14					29	30	32,700 cfs
14 ft			7			10	23	31	26	31						1		10					25	27	30,340 cfs
13 ft	9	1	6			2	6	10	12									8		31			21	24	28,050 cfs
12 ft	6						4	3	10									7	31	30	30	31	19	19	25,820 cfs
11 ft	5		5				3		9									5	19	27	21	30	14	12	23,660 cfs
10 ft	1		4						4	29	23							1	7	15	18	26	5	2	21,580 cfs
9 ft			3				2		1	26	22								5	8	15	24			19,570 cfs
8 ft			1							23	20								2	6	12	21	4		17,640 cfs
7 ft										12	13									3	6	18	3		15,780 cfs
6 ft										8	7										1	14	1		14,000 cfs
5 ft										2	5											8			12,310 cfs
4 ft																						2			10,700 cfs
3 ft																						1			9,173 cfs
2 ft																									7,740 cfs
1 ft																									6,401 cfs
0 ft																									5,161 cfs
(-)1 ft																									4,025 cfs

	1975												1976												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft	31	24	9	12	27																				52,000 cfs
21 ft	29		1	8	22																				48,500 cfs
20 ft	25	23		3																					45,500 cfs
19 ft	18	21			21																				42,810 cfs
18 ft	15	17			20																				40,190 cfs
17 ft	7	11			19											30		30							37,630 cfs
16 ft	5	10			18											29									35,130 cfs
15 ft	3	7			16							31	31	28		27		28	31						32,700 cfs
14 ft		2			15							29	30			26		27	27						30,340 cfs
13 ft	2				14							25	29	27	31	25	31	26	22	31					28,050 cfs
12 ft					13			31				19	28	26		23		24	19	29					25,820 cfs
11 ft					10			28				17	22	24	27	20	29	22	5	28					23,660 cfs
10 ft					9	30		27	30			14	18	23	22	19	26	20	2	22					21,580 cfs
9 ft					4	29		26	29			9	15	20	21	12	22	19		21		31			19,570 cfs
8 ft					3	24	31	23	24		30	6	12	19	18	9	18	16		20					17,640 cfs
7 ft					1	17		21	18	31	29	4	8	13	12	7	13	8		17		30	30		15,780 cfs
6 ft						14	28	18	15	27	27	2	3	11	8		11	6		14	30	24	29	31	14,000 cfs
5 ft						2	21	10	8	26	22	1		9		2	7	4		8	28	18	26	30	12,310 cfs
4 ft							15	3		19	16			4			2	2		5	23	13	23	26	10,700 cfs
3 ft							4		4	6	7									4	19	7	20	22	9,173 cfs
2 ft									3	2	3										10	6	11	16	7,740 cfs
1 ft																					4	3	6	11	6,401 cfs
0 ft																					1		2	3	5,161 cfs
(-)1 ft																									4,025 cfs

	1977												1978												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft				22											29	26	31								52,000 cfs
21 ft															28	22								31	48,500 cfs
20 ft				21											26	9	29							28	45,500 cfs
19 ft				20													27							27	42,810 cfs
18 ft				20											24	8	23							26	40,190 cfs
17 ft				19											15		18							23	37,630 cfs
16 ft				18											14	7	17							20	35,130 cfs
15 ft															9		16							19	32,700 cfs
14 ft				17					30			31			8		14							18	30,340 cfs
13 ft			27	16						31		27			5	6	13						30	17	28,050 cfs
12 ft			26	14						29		15			3	5	8						29	14	25,820 cfs
11 ft			22	13					29	28	30	12	31			3	4	30					28	13	23,660 cfs
10 ft	31		18	11	31					27	26	8	26	28	2	1		27					27	11	21,580 cfs
9 ft	30			7	30				28	26	21	4	20	25	1		2	20	31				25	9	19,570 cfs
8 ft	27		16	4	25				27	25	10	2	13	19				18	29		30		24	7	17,640 cfs
7 ft	26		13	2	16				26	24	4		6	13				9	23	31	28		21	5	15,780 cfs
6 ft	23	28	7		9				25	21				2				5	20	30	24		19	3	14,000 cfs
5 ft	17	26			5	30		31	24	15								1	14	27	21		15	2	12,310 cfs
4 ft	15	21	2		4	29	31	28	22	10									10	24	14	31	10		10,700 cfs
3 ft	7	11	1		1	28	26	22	17	4	2								4	14	11	25	1		9,173 cfs
2 ft	3	7				19	11	14	2	1	1									8	5	21			7,740 cfs
1 ft	1	2				4	1	9												1	1	8			6,401 cfs
0 ft								1														3			5,161 cfs
(-)1 ft																									4,025 cfs

Newport 1979-1984

1979

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft			16		6								52,000 cfs
21 ft		25	6		5								48,500 cfs
20 ft					4	30							45,500 cfs
19 ft	31	24			2	29							42,810 cfs
18 ft	29					28							40,190 cfs
17 ft	27					27							37,630 cfs
16 ft	26					25							35,130 cfs
15 ft	24					20						31	32,700 cfs
14 ft	18					19						30	30,340 cfs
13 ft	13	23				9	31	31	30			29	28,050 cfs
12 ft	10					6	27	23	27			28	25,820 cfs
11 ft	3	22				2	3	1	22	31			23,660 cfs
10 ft		19							20	30		25	21,580 cfs
9 ft		18							16	25	30		19,570 cfs
8 ft		16							12	24	29	24	17,640 cfs
7 ft		11							11	23	23	22	15,780 cfs
6 ft		3							6	13	19	19	14,000 cfs
5 ft									2	9	13	17	12,310 cfs
4 ft									1	6	9	9	10,700 cfs
3 ft										3	6	3	9,173 cfs
2 ft										1	1		7,740 cfs
1 ft													6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1980

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft													52,000 cfs
21 ft													48,500 cfs
20 ft													45,500 cfs
19 ft													42,810 cfs
18 ft													40,190 cfs
17 ft													37,630 cfs
16 ft													35,130 cfs
15 ft													32,700 cfs
14 ft													30,340 cfs
13 ft				30									28,050 cfs
12 ft				29									25,820 cfs
11 ft		28	31	20	31								23,660 cfs
10 ft	31	27	30	13	30	30							21,580 cfs
9 ft	29	26	20	10	25	29							19,570 cfs
8 ft	23	25	12	4	19	25	31						17,640 cfs
7 ft	15	22	6	2	12	20	30					31	15,780 cfs
6 ft	11	15	2		7	19	22					30	14,000 cfs
5 ft	9	13			2	14	16	31			30	29	12,310 cfs
4 ft	4	5				10	11	24	30		29	28	10,700 cfs
3 ft	1					4	10	21	28		28	26	9,173 cfs
2 ft							8	15	24	31	25	20	7,740 cfs
1 ft							5	10	19	30	22	14	6,401 cfs
0 ft								3	10	29	8		5,161 cfs
(-)1 ft										10			4,025 cfs

1981

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft													52,000 cfs
21 ft													48,500 cfs
20 ft													45,500 cfs
19 ft													42,810 cfs
18 ft													40,190 cfs
17 ft													37,630 cfs
16 ft													35,130 cfs
15 ft													32,700 cfs
14 ft													30,340 cfs
13 ft													28,050 cfs
12 ft													25,820 cfs
11 ft													23,660 cfs
10 ft													21,580 cfs
9 ft		28											19,570 cfs
8 ft		27			31	30		31					17,640 cfs
7 ft		26			30	29		30					15,780 cfs
6 ft		25	31		22	21		29					14,000 cfs
5 ft	31		30		14	11		28					12,310 cfs
4 ft	26	23	22			5	31	26					10,700 cfs
3 ft	23	21	18	30		1	23	20	30		30		9,173 cfs
2 ft	21	12	7	21	12		15	9	26		24		7,740 cfs
1 ft	14	2	2	16	8		5		21	31	22	31	6,401 cfs
0 ft	6			5					17	30	9	9	5,161 cfs
(-)1 ft										15			4,025 cfs

1982

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft		12											52,000 cfs
21 ft		6											48,500 cfs
20 ft													45,500 cfs
19 ft		1											42,810 cfs
18 ft			31										40,190 cfs
17 ft			30										37,630 cfs
16 ft	31		26								30	3	35,130 cfs
15 ft			22								29	2	32,700 cfs
14 ft			18									1	30,340 cfs
13 ft	30		15										28,050 cfs
12 ft	26			30	31								25,820 cfs
11 ft	24		7	29	30	30	31		30		28		23,660 cfs
10 ft			5	25	29	29	28	31	29				21,580 cfs
9 ft			1	25	28	28	27	30	27				19,570 cfs
8 ft	23			17	25	21	25	28		31			17,640 cfs
7 ft				14	20	15	23	25	25	30	27		15,780 cfs
6 ft	20			8	13	11	21	21	24		24		14,000 cfs
5 ft	19			5	6	8	17	15	20	28	23		12,310 cfs
4 ft	18				1	5	8	12	16	27	16		10,700 cfs
3 ft	16					1	2	9	9	26	11		9,173 cfs
2 ft	6							2	3	13	6		7,740 cfs
1 ft	3									2	1		6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1983

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft	24	28			10								52,000 cfs
21 ft	21	21		30	7								48,500 cfs
20 ft	16	17		27	6							31	45,500 cfs
19 ft		15		21	5							27	42,810 cfs
18 ft		12		11	4							14	40,190 cfs
17 ft				8	3							8	37,630 cfs
16 ft		8		5								5	35,130 cfs
15 ft					2							4	32,700 cfs
14 ft		7	31		1							1	30,340 cfs
13 ft		5	29			30					30		28,050 cfs
12 ft		2	27	3		24					29		25,820 cfs
11 ft			22			14	31				28		23,660 cfs
10 ft			18	2		11	29				25		21,580 cfs
9 ft			7			2	18	31			23		19,570 cfs
8 ft			1				8	30	30				17,640 cfs
7 ft							5	25	28				15,780 cfs
6 ft							4	16	26		22		14,000 cfs
5 ft							1	11	22				12,310 cfs
4 ft								7	19	31	20		10,700 cfs
3 ft								4	15		19		9,173 cfs
2 ft									13	30	15		7,740 cfs
1 ft									8	20	8		6,401 cfs
0 ft										8	4		5,161 cfs
(-)1 ft													4,025 cfs

1984

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft			31	28	24					30		16	52,000 cfs
21 ft			29	13						29		15	48,500 cfs
20 ft			28	2	23					25	27	13	45,500 cfs
19 ft			27		20					22	25	8	42,810 cfs
18 ft			23		16					21	21	1	40,190 cfs
17 ft			19		13						17		37,630 cfs
16 ft			17		9						14		35,130 cfs
15 ft			13								13		32,700 cfs
14 ft			9		8						11		30,340 cfs
13 ft	31		2		7					20	7		28,050 cfs
12 ft		28			6					19	6		25,820 cfs
11 ft		26			5	30					4		23,660 cfs
10 ft	30	24			4	28				17	3		21,580 cfs
9 ft	29	21				24							19,570 cfs
8 ft	26	18				20							17,640 cfs
7 ft	24	14				15	31	31	30	16			15,780 cfs
6 ft	11	11				12	30	29	28	12			14,000 cfs
5 ft	1	8				6	24	26	24	9			12,310 cfs
4 ft		1				4	17	17	19	6			10,700 cfs
3 ft							10	10	16	2			9,173 cfs
2 ft							3	5	7	1			7,740 cfs
1 ft									1				6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

Newport 1985-1990

1985

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft		9			29						30	31	52,000 cfs
21 ft					28							11	48,500 cfs
20 ft					27						28	9	45,500 cfs
19 ft					25							6	42,810 cfs
18 ft					21							3	40,190 cfs
17 ft					17								37,630 cfs
16 ft					16						27		35,130 cfs
15 ft					15	30							32,700 cfs
14 ft					14	29					25		30,340 cfs
13 ft					11	25	31				23		28,050 cfs
12 ft					5	12	20	31			22		25,820 cfs
11 ft					1	2	1	1		31	20		23,660 cfs
10 ft									30	30			21,580 cfs
9 ft									18	27			19,570 cfs
8 ft									11	23			17,640 cfs
7 ft									6	19	19		15,780 cfs
6 ft									3	14	17		14,000 cfs
5 ft									1	11	12		12,310 cfs
4 ft										7	9		10,700 cfs
3 ft										4	4		9,173 cfs
2 ft										1			7,740 cfs
1 ft													6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1986

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft	31			30									52,000 cfs
21 ft	26			28									48,500 cfs
20 ft	24			25									45,500 cfs
19 ft	22			19									42,810 cfs
18 ft	20			14	31								40,190 cfs
17 ft	17			9	30								37,630 cfs
16 ft	15				29								35,130 cfs
15 ft					28	30							32,700 cfs
14 ft						29							30,340 cfs
13 ft	14	28	31	8	27	24							28,050 cfs
12 ft		26	26	7	20	20							25,820 cfs
11 ft		22	20		13	14							23,660 cfs
10 ft	13	21	13		4	9	31	31					21,580 cfs
9 ft	10	11	10	5		4	30	30			30		19,570 cfs
8 ft	7	4	6			1	29	29			29	31	17,640 cfs
7 ft	2	3	3	4			25	28	30			30	15,780 cfs
6 ft		2	2	3			17	26	26	31	27	26	14,000 cfs
5 ft							10	20	19	30	25	15	12,310 cfs
4 ft							7	13	13	25	23	10	10,700 cfs
3 ft							2	5	10	16	16	8	9,173 cfs
2 ft								2	7	11	8	6	7,740 cfs
1 ft								1	4		1	4	6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1987

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft												26	52,000 cfs
21 ft			31										48,500 cfs
20 ft			29										45,500 cfs
19 ft			21										42,810 cfs
18 ft			16	30								25	40,190 cfs
17 ft			12	29								24	37,630 cfs
16 ft			9	28								18	35,130 cfs
15 ft		28	6	27									32,700 cfs
14 ft		27	3	25									30,340 cfs
13 ft		26		24								16	28,050 cfs
12 ft		25	2	19									25,820 cfs
11 ft		23		13	31								23,660 cfs
10 ft		22		10	29						30	15	21,580 cfs
9 ft				5	26						27	14	19,570 cfs
8 ft		19		3	23						25	10	17,640 cfs
7 ft				2	13	30					23		15,780 cfs
6 ft	31				8	25	31	31			21	7	14,000 cfs
5 ft	30	16			4	21	24	28			19	5	12,310 cfs
4 ft	27	15				15	17	25			16	3	10,700 cfs
3 ft	23	13				8	9	22	30		15	2	9,173 cfs
2 ft	17	9				1	2	20	29	31	12		7,740 cfs
1 ft	8							12	23	30			6,401 cfs
0 ft								5	13	27	10		5,161 cfs
(-)1 ft										8	8		4,025 cfs

1988

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft	21			27									52,000 cfs
21 ft	13	28	31	9									48,500 cfs
20 ft	6	27	29	1									45,500 cfs
19 ft	4	25	27		31						30		42,810 cfs
18 ft	3		15								29		40,190 cfs
17 ft		24	8								27	31	37,630 cfs
16 ft		20	4								23	29	35,130 cfs
15 ft		17			30						22	27	32,700 cfs
14 ft		10			29							26	30,340 cfs
13 ft		6			28							25	28,050 cfs
12 ft		5			25							24	25,820 cfs
11 ft		4	3									22	23,660 cfs
10 ft		2	2		22								21,580 cfs
9 ft		1	1		19	30						19	19,570 cfs
8 ft					15	29		31			19	16	17,640 cfs
7 ft					13	27	31	30				13	15,780 cfs
6 ft					10	23	30	25		31		12	14,000 cfs
5 ft					5	18	28	19	30	29	18	8	12,310 cfs
4 ft					1	13	18	17	23	23	14	6	10,700 cfs
3 ft						9	10	11	15	17	10	4	9,173 cfs
2 ft						5	4	7	8	5	9		7,740 cfs
1 ft						2		3	5	1	1		6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1989

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft			15	20									52,000 cfs
21 ft		14		9									48,500 cfs
20 ft		12											45,500 cfs
19 ft		8		6									42,810 cfs
18 ft		5		5									40,190 cfs
17 ft				4	31								37,630 cfs
16 ft				3	30								35,130 cfs
15 ft					29								32,700 cfs
14 ft	31	3			27	30							30,340 cfs
13 ft	28	2			23	29							28,050 cfs
12 ft	25				20	28							25,820 cfs
11 ft	22				16	22	31						23,660 cfs
10 ft	18				13	19	29						21,580 cfs
9 ft	11				11	15	28						19,570 cfs
8 ft	7				10	7	23						17,640 cfs
7 ft	2				8	3	19	31		31			15,780 cfs
6 ft					6		14	29	30	30	30		14,000 cfs
5 ft					2		9	26	28	25	29		12,310 cfs
4 ft							8	20	26	21	25		10,700 cfs
3 ft							2	15	25	16	22	31	9,173 cfs
2 ft								9	11	11	16	28	7,740 cfs
1 ft								1	6	6	10	25	6,401 cfs
0 ft										1	5	16	5,161 cfs
(-)1 ft													4,025 cfs

1990

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft			30	22	24							30	52,000 cfs
21 ft		28	18	11	22							27	48,500 cfs
20 ft		24	11	4	18	30							45,500 cfs
19 ft		20	6		12	29						22	42,810 cfs
18 ft		16	2		5	26							40,190 cfs
17 ft		13				25							37,630 cfs
16 ft		12				22							35,130 cfs
15 ft		10				21						21	32,700 cfs
14 ft		6				16	31			31			30,340 cfs
13 ft		3				2	24	31	30	30		20	28,050 cfs
12 ft		2					23	25	19	28		19	25,820 cfs
11 ft							11		16	28		17	23,660 cfs
10 ft	31									27		16	21,580 cfs
9 ft	30								14	22	30	13	19,570 cfs
8 ft	25	1								20	29	11	17,640 cfs
7 ft	23								11	14			15,780 cfs
6 ft	21								7	9		9	14,000 cfs
5 ft									3	8	28	6	12,310 cfs
4 ft									1	5	24	2	10,700 cfs
3 ft											13		9,173 cfs
2 ft	19										6		7,740 cfs
1 ft											1		6,401 cfs
0 ft	18												5,161 cfs
(-)1 ft													4,025 cfs

Newport 1991-1996

1991

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft	17				25							28	52,000 cfs
21 ft	7	28			24						30	20	48,500 cfs
20 ft		22			23						26	17	45,500 cfs
19 ft		21	31		22						24	15	42,810 cfs
18 ft		20	30	13	20					31	19	8	40,190 cfs
17 ft		18	28	11	17						17	2	37,630 cfs
16 ft		16	26	6	13						16		35,130 cfs
15 ft		15		3	7						14	1	32,700 cfs
14 ft		12	24	1	1						13		30,340 cfs
13 ft		9				30	31				12		28,050 cfs
12 ft		6	23			18	22				11		25,820 cfs
11 ft		5				9	16				4		23,660 cfs
10 ft		2	22			3	15			30			21,580 cfs
9 ft			18				12				2		19,570 cfs
8 ft			14										17,640 cfs
7 ft			9				10						15,780 cfs
6 ft			5				7	31					14,000 cfs
5 ft			3				5	28	30				12,310 cfs
4 ft							2	21	26	29			10,700 cfs
3 ft								11	16	23			9,173 cfs
2 ft								4	12	15			7,740 cfs
1 ft									10	3			6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1992

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft												29	52,000 cfs
21 ft												17	48,500 cfs
20 ft												16	45,500 cfs
19 ft													42,810 cfs
18 ft													40,190 cfs
17 ft				30							30	15	37,630 cfs
16 ft	31			28							28		35,130 cfs
15 ft	30	28		23	31						23	12	32,700 cfs
14 ft	28	25	31		29	30	31					6	30,340 cfs
13 ft	24		26		27	28	30						28,050 cfs
12 ft	19	23	23		26	27	28						25,820 cfs
11 ft	13	19	20	20		17	22						23,660 cfs
10 ft	12	16	18	18	25	9	15				22		21,580 cfs
9 ft	8	15	13	16	24		11				21		19,570 cfs
8 ft	3	14	2	14	22	5	10	31			19		17,640 cfs
7 ft	2	12		13	20		9	28	30		16		15,780 cfs
6 ft	1	9		9	13	4	7	24	26	31	11		14,000 cfs
5 ft		4		1	1		4	18	19	22	6		12,310 cfs
4 ft								10	10	9			10,700 cfs
3 ft								3	1	3	4		9,173 cfs
2 ft								1		2	2		7,740 cfs
1 ft													6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1993

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft	21	28	31	25	31							31	52,000 cfs
21 ft	6		27	23	29						30	21	48,500 cfs
20 ft	4	21	20	17	26						22	12	45,500 cfs
19 ft	2	18	14	12	16						17	10	42,810 cfs
18 ft		13	7	5								3	40,190 cfs
17 ft		6	3										37,630 cfs
16 ft				3	10						15		35,130 cfs
15 ft		2		1	9	30			30	31			32,700 cfs
14 ft		1				29			28		14		30,340 cfs
13 ft						23	31		26	30	12		28,050 cfs
12 ft						9	28			9	4		25,820 cfs
11 ft						2	19			2			23,660 cfs
10 ft							8	31	25				21,580 cfs
9 ft								29					19,570 cfs
8 ft							1	26	24				17,640 cfs
7 ft								21	23				15,780 cfs
6 ft								16	22				14,000 cfs
5 ft								10	16				12,310 cfs
4 ft								7	14				10,700 cfs
3 ft								3	5				9,173 cfs
2 ft								1					7,740 cfs
1 ft													6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1994

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft	30	25	26	28							29	28	52,000 cfs
21 ft	27	23	16	23								27	48,500 cfs
20 ft		15	5	16							28	26	45,500 cfs
19 ft		11		14							24	23	42,810 cfs
18 ft	24	10		10	31						18	22	40,190 cfs
17 ft	23			7	29						15	18	37,630 cfs
16 ft	21	9		5	19							17	35,130 cfs
15 ft	19	8		2	16						14	14	32,700 cfs
14 ft	17	4			13		31				10	10	30,340 cfs
13 ft	9	2			12	30	30				7	9	28,050 cfs
12 ft	4	1			9	19	25	31				5	25,820 cfs
11 ft	1					3	6	29				2	23,660 cfs
10 ft							1	27				1	21,580 cfs
9 ft								24					19,570 cfs
8 ft								21	30		5		17,640 cfs
7 ft								14	28				15,780 cfs
6 ft								10	22	31			14,000 cfs
5 ft								5	19	30			12,310 cfs
4 ft									11	23			10,700 cfs
3 ft									4	9	4		9,173 cfs
2 ft									1	1	3		7,740 cfs
1 ft													6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1995

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft	31				29								52,000 cfs
21 ft	30		31		26								48,500 cfs
20 ft	25		29		23								45,500 cfs
19 ft	21		27		19								42,810 cfs
18 ft	17	28	26		17								40,190 cfs
17 ft	14	24	20		16								37,630 cfs
16 ft		21	19		15								35,130 cfs
15 ft		17	16	30	14			31					32,700 cfs
14 ft		15	4	28	13	30		30					30,340 cfs
13 ft	13	12	2	19	12	28	31	29					28,050 cfs
12 ft	12	6	1	15	8	11	12	16				30	25,820 cfs
11 ft	11	5		13		3		9				28	23,660 cfs
10 ft	10	1		7				2				27	21,580 cfs
9 ft	8			2					30				19,570 cfs
8 ft	3			2					29			25	17,640 cfs
7 ft									27		30	24	15,780 cfs
6 ft									16	31	29	23	14,000 cfs
5 ft									8	27	25	22	12,310 cfs
4 ft									4	21	12	20	10,700 cfs
3 ft									1	15	8	14	9,173 cfs
2 ft										2	3	8	7,740 cfs
1 ft											1	2	6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1996

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft											22	9	52,000 cfs
21 ft											21	6	48,500 cfs
20 ft											21	4	45,500 cfs
19 ft				30					30		21	3	42,810 cfs
18 ft				28							19	1	40,190 cfs
17 ft				27									37,630 cfs
16 ft				27					29		17		35,130 cfs
15 ft				26	31				28		13		32,700 cfs
14 ft				23	25						11		30,340 cfs
13 ft				23	16	30			27		7		28,050 cfs
12 ft			31	23	5	23				31	6		25,820 cfs
11 ft		28	30	23		22					3		23,660 cfs
10 ft	31	27	30	23		17				29	3		21,580 cfs
9 ft	28	26	29	19		16				28	1		19,570 cfs
8 ft	25	25	24	16		15		31		24			17,640 cfs
7 ft	21	24		11		13	31	29	26	19			15,780 cfs
6 ft	19	20	21	4		7	30	24	25	12			14,000 cfs
5 ft	18	16	17			3	24	17	23	8			12,310 cfs
4 ft	10	9	15				18	15	20	3			10,700 cfs
3 ft	1	3	8				10	7	16				9,173 cfs
2 ft			2					2	6				7,740 cfs
1 ft													6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

Newport 1997-1999

1997

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft		28	3	21									52,000 cfs
21 ft		27		18									48,500 cfs
20 ft		26		17									45,500 cfs
19 ft		26		14									42,810 cfs
18 ft	31	25		12									40,190 cfs
17 ft	30	22		11									37,630 cfs
16 ft	29	21		9									35,130 cfs
15 ft	29	18		8									32,700 cfs
14 ft	27	10		7	31								30,340 cfs
13 ft	25	9			26								28,050 cfs
12 ft	11	7			19								25,820 cfs
11 ft	5	5			14	30							23,660 cfs
10 ft	4	2			14	26	31						21,580 cfs
9 ft	3				9	24	28		30				19,570 cfs
8 ft	1				5	21	24	31	29				17,640 cfs
7 ft					3	13	18	27	28				15,780 cfs
6 ft					2	8	5	24	25	31			14,000 cfs
5 ft						2	2	19	21	28		30	12,310 cfs
4 ft								10	19	19	30	27	10,700 cfs
3 ft								7	11	10	29	25	9,173 cfs
2 ft								5	7	7	20	21	7,740 cfs
1 ft								1			9	9	6,401 cfs
0 ft											1		5,161 cfs
(-)1 ft													4,025 cfs

1998

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft			23	26									52,000 cfs
21 ft			15	20									48,500 cfs
20 ft		28	6	19									45,500 cfs
19 ft		26	6	18									42,810 cfs
18 ft	31	24	5										40,190 cfs
17 ft	29	22	2	17									37,630 cfs
16 ft	28	17		16									35,130 cfs
15 ft	27	14		14	31								32,700 cfs
14 ft	26			4	25								30,340 cfs
13 ft	23				20	30							28,050 cfs
12 ft	21	11			11	27	31	31					25,820 cfs
11 ft	20				3	8	30	27					23,660 cfs
10 ft	19					3	28	21		31			21,580 cfs
9 ft	16	10					26	18		30			19,570 cfs
8 ft	14	7					14	12		29			17,640 cfs
7 ft	10	6					8	6	30	28		30	15,780 cfs
6 ft	6	4					6	1	27	26			14,000 cfs
5 ft	4	3					3		21	25		28	12,310 cfs
4 ft	4	1							9	23		24	10,700 cfs
3 ft	4								4	13	30	19	9,173 cfs
2 ft	3								1	3	25	11	7,740 cfs
1 ft										1	9	6	6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

1999

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft				30									52,000 cfs
21 ft				28									48,500 cfs
20 ft				25									45,500 cfs
19 ft				21									42,810 cfs
18 ft				17									40,190 cfs
17 ft		28	31	13									37,630 cfs
16 ft		21	24	11	31								35,130 cfs
15 ft		16	19	5	30								32,700 cfs
14 ft	31	12	16	2	26								30,340 cfs
13 ft	28	6	10		21	30	31						28,050 cfs
12 ft	20	4	9		10	28	30						25,820 cfs
11 ft	18		7			24	27						23,660 cfs
10 ft	17	3	5			20	23						21,580 cfs
9 ft	16	2	4			17	17						19,570 cfs
8 ft	13	1	2			12	11	31					17,640 cfs
7 ft	11	1	1			11	3	23					15,780 cfs
6 ft	10					7		15	29				14,000 cfs
5 ft	5					4		7	23				12,310 cfs
4 ft						3		5	19				10,700 cfs
3 ft						2		2	17				9,173 cfs
2 ft									13				7,740 cfs
1 ft									6				6,401 cfs
0 ft									4				5,161 cfs
(-)1 ft													4,025 cfs

2000

Stage	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	Flow
22 ft													52,000 cfs
21 ft													48,500 cfs
20 ft													45,500 cfs
19 ft													42,810 cfs
18 ft													40,190 cfs
17 ft													37,630 cfs
16 ft													35,130 cfs
15 ft													32,700 cfs
14 ft													30,340 cfs
13 ft													28,050 cfs
12 ft													25,820 cfs
11 ft													23,660 cfs
10 ft													21,580 cfs
9 ft													19,570 cfs
8 ft													17,640 cfs
7 ft													15,780 cfs
6 ft													14,000 cfs
5 ft													12,310 cfs
4 ft													10,700 cfs
3 ft													9,173 cfs
2 ft													7,740 cfs
1 ft													6,401 cfs
0 ft													5,161 cfs
(-)1 ft													4,025 cfs

Table 15 C. Calico Rock 1955-1960

	1955												1956												
	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft																									48,200 cfs
15 ft			31																						43,800 cfs
14 ft																									39,400 cfs
13 ft			30																						35,200 cfs
12 ft														28											31,000 cfs
11 ft					31	30	31																		27,000 cfs
10 ft					30	29								27											23,100 cfs
9 ft		28		30		28								25			31								19,300 cfs
8 ft			29			27	30							24			30	30							15,600 cfs
7 ft		27	27	29	29	24	28							23			29								12,500 cfs
6 ft		26	25	24	27	18	26	31	30					18	31	30	28	29	31	31	30			31	9,660 cfs
5 ft		25	23	11	21	9	6	23	27		30		31	7	30	25	23	26	28	29	28	31	30	28	7,020 cfs
5,900			22	9	8	3	3	8	11	31	29	31	30	4	17	11	13	23	17	18	14	26	21	15	5,900 cfs
4 ft	31	24	7	6				4	6	28	19	23	24	1	7	6	6	9	6	9		13	9	13	4,760 cfs
4,200	30	22	4	5	3	1	1	3	5	20	8	8	14		4	3	4	4	5	5	9		9	10	4,200 cfs
3,000		12			1						3	4	5		1							9			3,000 cfs
3 ft	29	11	1						2	5	2	3	4			1	1	1	1	3	3	8	5	5	2,880 cfs
2,000	25	1							1	1			1								1	4	1	2	2,000 cfs
2 ft	19																					1			1,560 cfs
1 ft																									600 cfs

	1957												1958												
	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft						30																			48,200 cfs
15 ft				28																					43,800 cfs
14 ft					29		31										31						30		39,400 cfs
13 ft				27	28	29	30	31									30								35,200 cfs
12 ft				22	26	26	21	25	30						31		28			31			29		31,000 cfs
11 ft				20	22	21	8	18	21	31					29	30	26	30		30					27,000 cfs
10 ft				18	15	9		17	6	28					27	28	25	23	31	29			28		23,100 cfs
9 ft			31	11	9	4		1		23	30				25	16	21	21	28	28			27		19,300 cfs
8 ft		28	29	3						20	29				21	4	16	17	21	24					15,600 cfs
7 ft		23	23							17	28		31		20		6	11	16	14	30		26		12,500 cfs
6 ft	31	21	18							15	24	31	25	28	10			2	11	1	28	31	23	31	9,660 cfs
5 ft	30	19	2							11	9	19	2	13	3				3		9	19	18	17	7,020 cfs
5,900	26	8								3	1			4							2	7	14	10	5,900 cfs
4 ft	12	4																				1	6	3	4,760 cfs
4,200	8	2												1									3	1	4,200 cfs
3,000																									3,000 cfs
3 ft	6																								2,880 cfs
2,000	1																						1		2,000 cfs
2 ft																									1,560 cfs
1 ft																									600 cfs

	1959												1960												
	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft																									48,200 cfs
15 ft																									43,800 cfs
14 ft																	30								39,400 cfs
13 ft				30													28								35,200 cfs
12 ft											30							30							31,000 cfs
11 ft																	27	29							27,000 cfs
10 ft				29		30						31		28			23	23							23,100 cfs
9 ft				28						31	29	30					16	21							19,300 cfs
8 ft				27		29				30	28		31	27	31		9		31						15,600 cfs
7 ft	31	28	31	25		28				29	27	29	30	26	27		6	20	30					31	12,500 cfs
6 ft	29	26	28	24	31	26		31	30	28	26	25	24	16	12	30		18	28	31				29	9,660 cfs
5 ft	19	14	18	12	22	18	31	29	29	26	23	16	13	4		22		14	27	30	30			25	7,020 cfs
5,900	8	6	6	3	13	11	26	17	24	23	14	11	7	1		9	5	8	19	17	26	31	30	20	5,900 cfs
4 ft	3	2	2	1	7	4	13	5	13	12	6	6	1				1	3	9	9	20	30	27	14	4,760 cfs
4,200	1		1		4	2	7	4	10	7	5	4				1		2	8	5	10	21	25	11	4,200 cfs
3,000								1	1															3	3,000 cfs
3 ft												1								1	3	4	11	2	2,880 cfs
2,000																							4		2,000 cfs
2 ft																							3		1,560 cfs
1 ft																									600 cfs

Calico Rock 1961-1966

1961

	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft					28								48,200 cfs
15 ft					27								43,800 cfs
14 ft													39,400 cfs
13 ft				30									35,200 cfs
12 ft				29	26								31,000 cfs
11 ft			31	28	25	30	31	31					27,000 cfs
10 ft			29	27		27	16	30					23,100 cfs
9 ft			28	18	24	21						31	19,300 cfs
8 ft			26	8	16	5		17				29	15,600 cfs
7 ft			22	2	8			16				22	12,500 cfs
6 ft	31	28	17	1	1			15			30	13	9,660 cfs
5 ft	18	17	5					11		31	29	8	7,020 cfs
5,900	3	12	1					9	30	30	28	6	5,900 cfs
4 ft		4						3	21	26	23	2	4,760 cfs
4,200	2	3						2	5	16	16		4,200 cfs
3,000								1			4		3,000 cfs
3 ft		1								2	4		2,880 cfs
2,000													2,000 cfs
2 ft													1,560 cfs
1 ft													600 cfs

1962

	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft													48,200 cfs
15 ft													43,800 cfs
14 ft													39,400 cfs
13 ft													35,200 cfs
12 ft													31,000 cfs
11 ft													27,000 cfs
10 ft	31	28		30									23,100 cfs
9 ft	29	27		29	31								19,300 cfs
8 ft	23	26	31	21	28								15,600 cfs
7 ft	21	18	27	7	24		31	31				31	12,500 cfs
6 ft	12	1	9	3	22		29	30	30	31		29	9,660 cfs
5 ft	5		4		10	30	14	19	27	28	30	20	7,020 cfs
5,900	1		3		6	26	11	14	18	18	29	16	5,900 cfs
4 ft					3	19			12	11	23	12	4,760 cfs
4,200					2	15	9	8	10	9	18	11	4,200 cfs
3,000						8	6			4	9	8	3,000 cfs
3 ft					1	6	5	3	3	2	7	7	2,880 cfs
2,000						1	1	2			1	4	2,000 cfs
2 ft								1				1	1,560 cfs
1 ft													600 cfs

1963

	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft													48,200 cfs
15 ft													43,800 cfs
14 ft													39,400 cfs
13 ft													35,200 cfs
12 ft													31,000 cfs
11 ft													27,000 cfs
10 ft													23,100 cfs
9 ft													19,300 cfs
8 ft													15,600 cfs
7 ft	31	28			31	30	31	31					12,500 cfs
6 ft	30	27	31	30		27	28	28	30	31	30		9,660 cfs
5 ft	25	20	24	27	29	20	23			26	29	31	7,020 cfs
5,900	23	13	13	24	28	18	18	24	28	22	26	24	5,900 cfs
4 ft	21	11	8		25	15		20	25	21		20	4,760 cfs
4,200	18	10	8	9	22	14	15	18	21	20	20	18	4,200 cfs
3,000	7	6			16	7		10	13	12	9		3,000 cfs
3 ft	5	5		5	15	6	14	9	12	11	9	14	2,880 cfs
2,000	3			2	6	2	7	5	11	3	3	8	2,000 cfs
2 ft					2				8	2		5	1,560 cfs
1 ft													600 cfs

1964

	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft			31										48,200 cfs
15 ft				30									43,800 cfs
14 ft													39,400 cfs
13 ft													35,200 cfs
12 ft													31,000 cfs
11 ft			30										27,000 cfs
10 ft				29	31								23,100 cfs
9 ft													19,300 cfs
8 ft			28	28	30			31					15,600 cfs
7 ft				27	29		31	30	30				12,500 cfs
6 ft			27	26	27	30	29	27	29			31	9,660 cfs
5 ft			26	24	23	29	21	25	25		30	28	7,020 cfs
5,900	31		25	23	22	28	17	24	24		28		5,900 cfs
4 ft	30		22	14	16		12	22		31	26		4,760 cfs
4,200	28	28	18	8	15	23	8	20	22	28	23	26	4,200 cfs
3,000	23	22	10	4	8	12	6	16		22		22	3,000 cfs
3 ft	23	21	8	3	5	10	5	14	19	21	15	21	2,880 cfs
2,000	11	14	6	1	1	4	3	6	15	10	9	12	2,000 cfs
2 ft	8	8	4			2	1	3	8	8	3	7	1,560 cfs
1 ft													600 cfs

1965

	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft													48,200 cfs
15 ft													43,800 cfs
14 ft													39,400 cfs
13 ft													35,200 cfs
12 ft													31,000 cfs
11 ft													27,000 cfs
10 ft				30	31								23,100 cfs
9 ft								31					19,300 cfs
8 ft				29	30		31	30					15,600 cfs
7 ft	31	28		26	26	30	29	26	30	31			12,500 cfs
6 ft		26	31	18	18	29	27	20	27	30	30	31	9,660 cfs
5 ft		23	26	13	11	17	22	15	23	28	25	25	7,020 cfs
5,900	30	20	24	9	9	13	14	13		25	20	20	5,900 cfs
4 ft	22		17	6	8		10		22	22	13	13	4,760 cfs
4,200	19	14	16	2	6	8	8	9	17	21	10	12	4,200 cfs
3,000	10	8	8				1		7	16			3,000 cfs
3 ft	8	6	7		3	3		5	5	15	7	6	2,880 cfs
2,000	4		1		2			1	4	8		1	2,000 cfs
2 ft	2	1								3			1,560 cfs
1 ft													600 cfs

1966

	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft	31	27											48,200 cfs
15 ft	30			29									43,800 cfs
14 ft													39,400 cfs
13 ft													35,200 cfs
12 ft													31,000 cfs
11 ft		26		28									27,000 cfs
10 ft		24		27									23,100 cfs
9 ft		21	31	26	31	30	31						19,300 cfs
8 ft	29	19	27	25	20	28	29	31					15,600 cfs
7 ft	26	16	19	18	9	23	22	29	30				12,500 cfs
6 ft	14	7	6	10	2	19	20	26	28	31	30	31	9,660 cfs
5 ft	5	3	2	6		8	15	23	23	29	23	28	7,020 cfs
5,900	4			5			12	16	21	24	22	24	5,900 cfs
4 ft						3	10		17	20	20	22	4,760 cfs
4,200	2	2		1		2	9	9	15	15	18	21	4,200 cfs
3,000											13	15	3,000 cfs
3 ft		1					6	2	8	10	13	13	2,880 cfs
2,000							1		3	5	10	9	2,000 cfs
2 ft								1	1	4	5	5	1,560 cfs
1 ft													600 cfs

Calico Rock 1967-1972

	1967 J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	1968 J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
16 ft															30										48,200 cfs
15 ft														28										30	43,800 cfs
14 ft															29										39,400 cfs
13 ft												31		27											35,200 cfs
12 ft														26		30							30	29	31,000 cfs
11 ft											30	29		25	28	29							29	20	27,000 cfs
10 ft										31		28	31	17	26	27	31	30					27	17	23,100 cfs
9 ft												27	30	8	24	19	29	25	31				25	9	19,300 cfs
8 ft					31		31	31		29	29	23	25	3	18	12	24	13	12	31		31	14	6	15,600 cfs
7 ft	31	28			30	30	28	30		27	25	19	19		11	6	16	7	10	24	30	26	6		12,500 cfs
6 ft	30	27	31	30	28		25	26		26	22	10	13	2			14	4	7	21	29	17	2		9,660 cfs
5 ft	24	24	28	21	20	28	18	24		24	12	6	7		9				5	14		12			7,020 cfs
5,900	21	21	26	16	13	26	15	23	30	20	9	5	6	1	6						26	9	1		5,900 cfs
4 ft	17	14	19	9	8	22	7	20	27	15	7	3	4						4	13	23				4,760 cfs
4,200	16	12	18	6	7	19	5	18	22	11	6		3		5				2	11	21	6			4,200 cfs
3,000	11			4			3	11		5					3						11				3,000 cfs
3 ft	10	10	10		3	16	2	10	17	4	1	2	2		2				1	2	10	2			2,880 cfs
2,000	6	4	5	3	1	9	1	6	7	1			1		1						2				2,000 cfs
2 ft	3	2	2	1		5		2	3																1,560 cfs
1 ft																									600 cfs

	1969 J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	1970 J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
16 ft																									48,200 cfs
15 ft																									43,800 cfs
14 ft																									39,400 cfs
13 ft	29															29									35,200 cfs
12 ft		28	31													27									31,000 cfs
11 ft	28	27	26	30	31											24						31		31	27,000 cfs
10 ft	16	20	3	24	29											22	31					30		26	23,100 cfs
9 ft	5	9	2	15	15								31			21	27				30	29	30	20	19,300 cfs
8 ft				3	6	30	31						28			20	17		31	31	29	28	25	8	15,600 cfs
7 ft				1	2	29	28	31	30	31		31	25				8	30	28	30	24	21	17	2	12,500 cfs
6 ft						26	23	27	28	30	30	30	19	28	31	18	4	28	24	26	20	12	7		9,660 cfs
5 ft						23	18	18	26	27	25	23	15	26	26	16		21	22	23	17	8			7,020 cfs
5,900						15	15	13	25	15	23	18	14	24	23	12	1	15	19	21	16	6			5,900 cfs
4 ft						12	11	12	22	8	21	11	11	19	14	9		8	14	11	12	3			4,760 cfs
4,200						9	9	11	19	6	19		9	17	13	8		4	11	8	7	2			4,200 cfs
3,000						4	5		12			9	6	9							3				3,000 cfs
3 ft						3	4	4	10	5	13	8	5	8		4			3	2	2	1			2,880 cfs
2,000								2	6	2	4	4		3	3				1						2,000 cfs
2 ft									3		2	1		1	1										1,560 cfs
1 ft																									600 cfs

	1971 J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	1972 J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
16 ft																									48,200 cfs
15 ft																									43,800 cfs
14 ft												30													39,400 cfs
13 ft																									35,200 cfs
12 ft																							30		31,000 cfs
11 ft	31											29				30									27,000 cfs
10 ft	30		31																				29		23,100 cfs
9 ft	18	28	29		31				30	31												31	27	31	19,300 cfs
8 ft	15	22	23		30	30		31	27		30	28	31		31	29	31		31	31	30		26	29	15,600 cfs
7 ft	10	13	16		27	27	31	30	25	30	28	27	28		30	26	26	30	27	27	27	30	25	28	12,500 cfs
6 ft	4	8	10	30	23	24	29	27	23	29	25	25	26	28	29	21	22	29	23	20	24	27	24	24	9,660 cfs
5 ft	1	2		27	17	15	26	22	21	25	24	22	22	26	24	13	19	24	16	16	23	23	12	21	7,020 cfs
5,900		1	9	25	14	11	25	21	19	22	23	21	20	23	21	9	13	23	14	13	19	19	8	15	5,900 cfs
4 ft			6	14	8	8		19	17	21	21	18	18	19	19	6	10	20		10	15			7	4,760 cfs
4,200			4	10	6	7	22	18	16	17	19	14	16	15	15	5	9	17	13	6	12	14	4	6	4,200 cfs
3,000				7						15		11	8	12				9	10						3,000 cfs
3 ft			1	6	2		16	12	10	13	18	10	7	11	10	2	1	7	9	4	10	9	1	1	2,880 cfs
2,000				2		1	5	7		9	14	8	2	1	2			1	5		7	5			2,000 cfs
2 ft				1			3	4	4	5	10	7			1				1	2	4	2			1,560 cfs
1 ft																									600 cfs

Calico Rock 1973-1978

	1973												1974												
	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft				28								31													48,200 cfs
15 ft			30		31																				43,800 cfs
14 ft			29	27	29													30							39,400 cfs
13 ft				26	23						30	30													35,200 cfs
12 ft		28	28	22	12						29		31	28											31,000 cfs
11 ft	31	25	27	15	9			31	30			29	23	17	31	30	31	29					30	31	27,000 cfs
10 ft	30	16	26	9	6	30	31	28	24		28	28	17	6	27	19	29		31	31	30	31	29	24	23,100 cfs
9 ft	29	9	12	1	4	28	12	5	12	31	27	24	16		9	11	24	27	30	30	26	28	28	22	19,300 cfs
8 ft	27	3	9		2	18	4		6	30	26	17	14		5	5	19	25	14	12	15	24	27	12	15,600 cfs
7 ft	21		6			9			2	27	25	6	7		3	4	17	22	6	7	14	19	21	1	12,500 cfs
6 ft	14	1				4			1	19	21	2			1	2	7	17	2	5	11	16	7		9,660 cfs
5 ft	10		5				2			10	11							6			2	8			7,020 cfs
5,900	5		4							7	8					1		3			1	3	1		5,900 cfs
4 ft			3			2				3	7														4,760 cfs
4,200	1		2							1	5							2							4,200 cfs
3,000											3														3,000 cfs
3 ft											2											2			2,880 cfs
2,000																									2,000 cfs
2 ft																									1,560 cfs
1 ft																									600 cfs

	1975												1976												
	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft			31																						48,200 cfs
15 ft			30																						43,800 cfs
14 ft			29																						39,400 cfs
13 ft		28		30																					35,200 cfs
12 ft	31	27	28	23	31																				31,000 cfs
11 ft	29	26	24	16	24											30		30							27,000 cfs
10 ft	18	23	5	1												29		29	31	31					23,100 cfs
9 ft	6	11			22			31				31	31			25	31		27	30		31			19,300 cfs
8 ft	2	1			19		31	30	30	31	30	29	30		31	22	30	28	15	22	30	30	30		15,600 cfs
7 ft					13	30	30	28	29	30	28	28	29		30	20	23	26	14	18	29	27	29	31	12,500 cfs
6 ft					8	26	27	26		26	26	23	25	28	24	17	17	17	4	14	27	19	24	30	9,660 cfs
5 ft								23	27	23	20	16	16			14	11			9	17	14	20	26	7,020 cfs
5,900						17	23	20	25	19	17	14	15	24	23	13	7	9			16	9	18	22	5,900 cfs
4 ft					5	15	17	16	23	16	14	9	10	22	20	10		7		6	14		13	20	4,760 cfs
4,200					3	13	14	12	22	15	12	6	8	20	19	8		6		4	13	6	11	19	4,200 cfs
3,000						7		4	15		8		3		9		4					5			3,000 cfs
3 ft						6	6	2	14	10	6	2	2	10	8	1	2	3			5	4	7	14	2,880 cfs
2,000						1	3		7	2	3			4	1								6	9	2,000 cfs
2 ft							2		5	1	2			2							2	2	4	6	1,560 cfs
1 ft																									600 cfs

	1977												1978												
	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft															31										48,200 cfs
15 ft			30																						43,800 cfs
14 ft																	31								39,400 cfs
13 ft																30									35,200 cfs
12 ft															30	28	30								31,000 cfs
11 ft															29	22	28								27,000 cfs
10 ft	31		29													17	19								23,100 cfs
9 ft	30										30		31		28	11	14								19,300 cfs
8 ft	27				31				30		28	31	30		25		12	30	31	31	30		30	31	15,600 cfs
7 ft	24	28	28		30					31	22	30	26	28	19	8		29	30	30	28	31	28	28	12,500 cfs
6 ft	20	26	27	30	26	30		31	29	29	18	21	22	26	10	3	1	14	23	28	22	30	25	26	9,660 cfs
5 ft	14	21	25	25	19	29		30	27	24	14	8	15	15	4	2		3	16	24	21	26	16	17	7,020 cfs
5,900	13		24	23	15	28	31		25	23	10	5	12	7		1			14	22		23	13	15	5,900 cfs
4 ft		18	18	19		27	27	29	24	20	8	2	6							12	20	20		9	4,760 cfs
4,200	6	16	15	15	13	24	20	23	21	19	5	1	3	4				2	8	11	16	17	8	8	4,200 cfs
3,000			5			16		12	17	14									3		6	8		6	3,000 cfs
3 ft	3	10	4	10	10	15	10	8	16	13	1			1					2		5	7	4	5	2,880 cfs
2,000	2	7		2	5	7	1	2	8	7										5		3	2	3	2,000 cfs
2 ft	1	3			4	1			1	2										2		2	1	2	1,560 cfs
1 ft																									600 cfs

Calico Rock 1979-1984

	1979												1980												
	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft																									48,200 cfs
15 ft																									43,800 cfs
14 ft				30	31																				39,400 cfs
13 ft					30																				35,200 cfs
12 ft			31	29	28																				31,000 cfs
11 ft			28	28	24																				27,000 cfs
10 ft	31	28	23	27	22			31		31															23,100 cfs
9 ft	30		20	23	16	30	31	23	30	30	30	31					31	30							19,300 cfs
8 ft	25	25	10	15	11	21	6	6	20	22	29		31	28	31		29	28	31		30			31	15,600 cfs
7 ft	15	22	8	5	6	11	3		17	21	26	28	30		28	30	25	23	24	31				30	12,500 cfs
6 ft	10	21	5		1	5		1	13	14	21	27	27	26	24	28	23	17	18	29	29		30	29	9,660 cfs
5 ft	7	20	1						6			21	21	23	14	21	12	13	11			31	28		7,020 cfs
5,900	4	17							5	7	18	20	16	17	11	16	8	10	10	22	26			27	5,900 cfs
4 ft	1	12							3		14	16	10	12	8	8	4	7	7	17			27	26	4,760 cfs
4,200		8							2	5	12	13	8	11	7	7	2	6	6	10	22	30	25	25	4,200 cfs
3,000												9		5					4				24	20	3,000 cfs
3 ft		3								3	10	8	4	4	2	1		1	3	7	16	27	23	20	2,880 cfs
2,000									1		7	2		1					1	3	8	23	13	13	2,000 cfs
2 ft										1	1	1	1								7	20	7	9	1,560 cfs
1 ft																									600 cfs

	1981												1982												
	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft														28											48,200 cfs
15 ft													31												43,800 cfs
14 ft													30												39,400 cfs
13 ft																									35,200 cfs
12 ft																								30	31,000 cfs
11 ft														27	31									28	27,000 cfs
10 ft														21									30	23	23,100 cfs
9 ft								31						17	30	30		30					29	20	19,300 cfs
8 ft		28			31								30	15	20	29	31	28	31	31	30		28	17	15,600 cfs
7 ft	31	27	31		30			30					28	8	12	28		21	29	30		31	25	13	12,500 cfs
6 ft	30		29		29	30							27	4	10	27	30	15	22	29		30	21		9,660 cfs
5 ft	25	26	28		26		31	29								23		12	18	25	26		18		7,020 cfs
5,900		25	27		24	26	29	24	30	31			26	2	1	18	29	11	15	22	25	27	13		5,900 cfs
4 ft		23	25		19	17	28	14	29				25			17	28		12	20	23	25	9		4,760 cfs
4,200	22	22	23	30	18	11	25	8	24	30			24			14	27	7	8	13	19	22	8		4,200 cfs
3,000	17			29			10		18							7	16		3	5			5		3,000 cfs
3 ft	16	15	15	28	15	5	9	1	17	29	30	31	19			4	15	2	2	3	10	14	4		2,880 cfs
2,000	7	7	5	26	7		1		5	28		28	15			3	3		1		4	5			2,000 cfs
2 ft	5	4	1	15	4				4	23	29	22	9								2	4			1,560 cfs
1 ft											2														600 cfs

	1983												1984												
	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	
16 ft																	31								48,200 cfs
15 ft																									43,800 cfs
14 ft	31																								39,400 cfs
13 ft	27	28		30																					35,200 cfs
12 ft	19	21		28	31							31			31	30							30	29	31,000 cfs
11 ft	14	12		28	29							29			28	27	30					31	29	28	27,000 cfs
10 ft	13			25	27						30	25			24	16	28					30	29	27	23,100 cfs
9 ft	12	9	31	8	19	30	31	31	30		30	21			17	9	25					29	27	24	19,300 cfs
8 ft	9	8	26	6	13	25	26	30	29		29	13			13	3	19	30	31	31	30	26	26	16	15,600 cfs
7 ft	8	2	19	3	5	12	11	22	27		27	7	31		9		12	25	30	29	29	24	23	12	12,500 cfs
6 ft	2	1	10	2	2	2	6	15	25		25	1	30	28	7		6	21	25	23	25	22	19	8	9,660 cfs
5 ft			3				4	10	20		24		28	26			3	15	20	13	24	16	14	2	7,020 cfs
5,900			2				3		19		23		26	24			2	10	16	12	23	13	11	1	5,900 cfs
4 ft								6		31	21		21	20	2		1	6	13	10	19	10	9		4,760 cfs
4,200							2	5	17	30	20		17	17				4	11	9	14	9	7		4,200 cfs
3,000									16				12	12					6	4		8	5		3,000 cfs
3 ft								3	15	24	17		11	8	1				4	2	8	7	4		2,880 cfs
2,000								1	6	17	13		3	2					1		5				2,000 cfs
2 ft									3	11	9			1							1	4			1,560 cfs
1 ft																						1			600 cfs

Calico Rock 1985-1990

1985

Stage	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	Flow
16 ft													48,200 cfs
15 ft				30									43,800 cfs
14 ft	31	26	29	29								31	39,400 cfs
13 ft	18	8	17	23							30	26	35,200 cfs
12 ft	13		7	21								14	31,000 cfs
11 ft	9		5	19							28	12	27,000 cfs
10 ft	8	4	2	16			31	31				10	23,100 cfs
9 ft	6	1	1	11		30	24	26	30	31	27	8	19,300 cfs
8 ft	2			4	31	29	4	2	28	24		7	15,600 cfs
7 ft					27	23			11	20	24	6	12,500 cfs
6 ft					17	6			9	17	21	2	9,660 cfs
5 ft					7	2			6	14	18		7,020 cfs
5,900									4	13	14		5,900 cfs
4 ft									3				4,760 cfs
4,200										9	9		4,200 cfs
3,000													3,000 cfs
3 ft										6	7		2,880 cfs
2,000									1		6		2,000 cfs
2 ft										2	4		1,560 cfs
1 ft													600 cfs

1986

Stage	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	Flow
16 ft													48,200 cfs
15 ft													43,800 cfs
14 ft	31			30									39,400 cfs
13 ft	28												35,200 cfs
12 ft	27												31,000 cfs
11 ft	25			29									27,000 cfs
10 ft	23		31	26			31				30		23,100 cfs
9 ft		28	30	24	31	30	29				29		19,300 cfs
8 ft	22	26	29	10	29	29	27	31	30		28		15,600 cfs
7 ft	17	22	26	6	18	28	24	29	26		27	31	12,500 cfs
6 ft	9	16	17	3	13	21	17	23	19	31	25	24	9,660 cfs
5 ft	6	11			8	10	11	18	16	27	21	21	7,020 cfs
5,900		9	9	2	7	8	8	17	13	22	18	18	5,900 cfs
4 ft	3	8	8		5	3		14		15	16	14	4,760 cfs
4,200		6	5		3	2	7	13	11	14	15	13	4,200 cfs
3,000		2							8	8	6	11	3,000 cfs
3 ft	2		4				4	8	7	7	5	9	2,880 cfs
2,000			2				1	5	6	1	3		2,000 cfs
2 ft			1					3	4		1	7	1,560 cfs
1 ft													600 cfs

1987

Stage	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	Flow
16 ft													48,200 cfs
15 ft												30	43,800 cfs
14 ft													39,400 cfs
13 ft												29	35,200 cfs
12 ft			31									27	31,000 cfs
11 ft		28	29									26	27,000 cfs
10 ft			24	30								25	23,100 cfs
9 ft		27	17	28	31							19	19,300 cfs
8 ft		26	6	20	28						30	17	15,600 cfs
7 ft		21	2	13	21	30	31	31	30		22	13	12,500 cfs
6 ft	31	20	1	8	19	26	29	29			19	9	9,660 cfs
5 ft	29	18		5	13	21	25	28	29			7	7,020 cfs
5,900	26	17			11	20	23	26	28				5,900 cfs
4 ft		16			8	14	20	22	25			5	4,760 cfs
4,200	25	15		3	7	12	18	20	24	31	14	4	4,200 cfs
3,000						9	11		19				3,000 cfs
3 ft	19	13		1	3	8	10	17	17	27	12	1	2,880 cfs
2,000	9	8				1	2	15	12	19	9		2,000 cfs
2 ft	5	1					1	6	9	16	7		1,560 cfs
1 ft										1			600 cfs

1988

Stage	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	Flow
16 ft													48,200 cfs
15 ft													43,800 cfs
14 ft			31	30									39,400 cfs
13 ft	31		30	28									35,200 cfs
12 ft	25		29	23									31,000 cfs
11 ft	23		27	16									27,000 cfs
10 ft	17	28	23	11	31								23,100 cfs
9 ft	13	22	11	4	28								19,300 cfs
8 ft	6	14	3	2	24	30		31		31	30	31	15,600 cfs
7 ft	5	11	2		22	26	31	27	30	30	28	30	12,500 cfs
6 ft	1	8	1		18		28	21	27	28	24	23	9,660 cfs
5 ft		4			15	18		16	23	21	18	17	7,020 cfs
5,900		3			13	16	25	15		19	14	14	5,900 cfs
4 ft						13	22	14	21	17	12	13	4,760 cfs
4,200		1			9	11	17	13	18	15	11	12	4,200 cfs
3,000					5							7	3,000 cfs
3 ft					4	8	3	8	13	11	5	6	2,880 cfs
2,000					1	5			4	4	2	1	2,000 cfs
2 ft								2	2	1	1		1,560 cfs
1 ft													600 cfs

1989

Stage	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	Flow
16 ft		26											48,200 cfs
15 ft													43,800 cfs
14 ft													39,400 cfs
13 ft		25	31	30									35,200 cfs
12 ft		24	24	25									31,000 cfs
11 ft		23	21	19									27,000 cfs
10 ft	31	22	18	14	31	30							23,100 cfs
9 ft	30	20	10	7	29								19,300 cfs
8 ft	29	14	5	2	26	29	31	31		31			15,600 cfs
7 ft	25	10	3		23	27	29	29	30	30	30		12,500 cfs
6 ft	20	3		1	17	22	22	27	29	24	28		9,660 cfs
5 ft	17	1				12	15	24	27	21	24		7,020 cfs
5,900	13				12	6	14	22	26	16	20	31	5,900 cfs
4 ft	9				11	4				13	19	30	4,760 cfs
4,200	6				8	3	13	17	24		17	29	4,200 cfs
3,000					3				17				3,000 cfs
3 ft	2				2		8	13	15	12	15	28	2,880 cfs
2,000	1						3	1	7	8	13	22	2,000 cfs
2 ft									2	4	9	18	1,560 cfs
1 ft													600 cfs

1990

Stage	J.	F.	M.	A.	M.	J.	J.	A	.S.	O.	N.	D.	Flow
16 ft													48,200 cfs
15 ft					29								43,800 cfs
14 ft			31										39,400 cfs
13 ft			29	30									35,200 cfs
12 ft			22	28									31,000 cfs
11 ft			18	20	28				30			31	27,000 cfs
10 ft		28	14	16	25	30	31	31	24			30	23,100 cfs
9 ft		21	6	6	20	24	22	4	18	31		28	19,300 cfs
8 ft		14	2	1	16	13	2		15	30		27	15,600 cfs
7 ft	31	9	1		7	9			10	22	30	23	12,500 cfs
6 ft	30	5			2	5				21	28	19	9,660 cfs
5 ft	28	3			1				4	14	24		7,020 cfs
5,900	26	2							3	11	18	12	5,900 cfs
4 ft	23								2	9	15	9	4,760 cfs
4,200	21								1	6	13	7	4,200 cfs
3,000											11		3,000 cfs
3 ft	20									2	9	5	2,880 cfs
2,000	16										7		2,000 cfs
2 ft	15										5		1,560 cfs
1 ft													600 cfs

Calico Rock 1991-1996

	1991												1992												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft	17				25							28												29	52,000 cfs
21 ft	7	28			24						30	20												17	48,500 cfs
20 ft		22			23						26	17												16	45,500 cfs
19 ft		21	31		22						24	15													42,810 cfs
18 ft		20	30	13	20					31	19	8													40,190 cfs
17 ft		18	28	11	17						17	2				30							30	15	37,630 cfs
16 ft		16	26	6	13						16		31			28							28		35,130 cfs
15 ft		15		3	7						14	1	30	28		23	31						23	12	32,700 cfs
14 ft		12	24	1	1						13		28	25	31		29	30	31					6	30,340 cfs
13 ft		9				30	31				12		24		26		27	28	30						28,050 cfs
12 ft		6	23			18	22				11		19	23	23		26	27	28						25,820 cfs
11 ft		5				9	16				4		13	19	20	20		17	22						23,660 cfs
10 ft		2	22			3	15			30			12	16	18	18	25	9	15				22		21,580 cfs
9 ft			18				12				2		8	15	13	16	24		11				21		19,570 cfs
8 ft			14										3	14	2	14	22	5	10	31			19		17,640 cfs
7 ft			9				10						2	12		13	20		9	28	30		16		15,780 cfs
6 ft			5				7	31					1	9		9	13	4	7	24	26	31	11		14,000 cfs
5 ft			3				5	28	30					4		1	1		4	18	19	22	6		12,310 cfs
4 ft							2	21	26	29										10	10	9			10,700 cfs
3 ft								11	16	23										3	1	3	4		9,173 cfs
2 ft								4	12	15										1		2	2		7,740 cfs
1 ft									10	3															6,401 cfs
0 ft																									5,161 cfs
(-)1 ft																									4,025 cfs

	1993												1994												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft	21	28	31	25	31							31	30	25	26	28							29	28	52,000 cfs
21 ft	6		27	23	29						30	21	27	23	16	23								27	48,500 cfs
20 ft	4	21	20	17	26						22	12		15	5	16							28	26	45,500 cfs
19 ft	2	18	14	12	16						17	10		11		14							24	23	42,810 cfs
18 ft		13	7	5								3	24	10		10	31						18	22	40,190 cfs
17 ft		6	3										23			7	29						15	18	37,630 cfs
16 ft				3	10						15		21	9		5	19							17	35,130 cfs
15 ft		2		1	9	30			30	31			19	8		2	16						14	14	32,700 cfs
14 ft		1				29			28		14		17	4			13		31				10	10	30,340 cfs
13 ft						23	31		26	30	12		9	2			12	30	30				7	9	28,050 cfs
12 ft						9	28			9	4		4	1			9	19	25	31				5	25,820 cfs
11 ft						2	19			2			1					3	6	29				2	23,660 cfs
10 ft							8	31	25										1	27				1	21,580 cfs
9 ft								29												24					19,570 cfs
8 ft							1	26	24											21	30		5		17,640 cfs
7 ft								21	23											14	28				15,780 cfs
6 ft								16	22											10	22	31			14,000 cfs
5 ft								10	16											5	19	30			12,310 cfs
4 ft								7	14												11	23			10,700 cfs
3 ft								3	5												4	9	4		9,173 cfs
2 ft								1													1	1	3		7,740 cfs
1 ft																									6,401 cfs
0 ft																									5,161 cfs
(-)1 ft																									4,025 cfs

	1995												1996												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
22 ft																									52,000 cfs
21 ft	31																						29		48,500 cfs
20 ft																									45,500 cfs
19 ft																					30		28		42,810 cfs
18 ft																					29				40,190 cfs
17 ft																								31	37,630 cfs
16 ft																								22	35,130 cfs
15 ft	30		31		30											30								17	32,700 cfs
14 ft																							27	9	30,340 cfs
13 ft	29		30																				26	8	28,050 cfs
12 ft	27		28	30												29							24	6	25,820 cfs
11 ft	23		27	29	29																		24	3	23,660 cfs
10 ft	22	28	24	29	28			31							31			30					24	1	21,580 cfs
9 ft	19	24	21	29	27	30	31	20							30	28		30				31	23		19,570 cfs
8 ft	13	17	15	28	27	30	29	12					31	28	30			30				30	21		17,640 cfs
7 ft	11	10	9	20	26	27	22	6						27		27	31	28				27	20		15,780 cfs
6 ft		6	6	17	24	18	13	4					30	27			29	23		31	28	25	17		14,000 cfs
5 ft		4	4	13	17	8	5	2	30				29	26			29	20	31	28	27	21	9		12,310 cfs
4 ft	10	4	4	10	12	6	2	2	28	31	30	30	28	24	28	26	26	15	30	24	25	17	3		10,700 cfs
3 ft	9	1	3	9	8	3	1		24	30	28	29	27	23	24	23	25	13	27	21	23	15	3		9,173 cfs
2 ft	8	1	1	5	4	1			14	28	26	27	24	22	19	20	22	9	23	17		13	1		7,740 cfs
1 ft	4	1		2	1				9	25	23	25	22	19	17	19	9	8	19	16		12			6,401 cfs
0 ft	4	1		2					7	21	19	22	22	16	16	16	3	7	14	12	19	8			5,161 cfs
(-)1 ft	1	1		2					7	18	16	18	19	14	13	12	1	2	11	4	17				4,025 cfs

Calico Rock 1997-1999

	1997												1998												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
2 ft																									52,000 cfs
1 ft																									48,500 cfs
0 ft																									45,500 cfs
9 ft															31										42,810 cfs
8 ft																									40,190 cfs
7 ft		28	31											28	30										37,630 cfs
6 ft		27	20	30											28										35,130 cfs
5 ft			17												27										32,700 cfs
4 ft		26	14											27	25	30									30,340 cfs
3 ft	31		13	28									31	25	23	29									28,050 cfs
2 ft	30		13	26									28	21	19	28									25,820 cfs
1 ft		25	11	25									28	19	16	27									23,660 cfs
0 ft	29	24	8	23	31								28	17	14	26		30							21,580 cfs
9 ft	27	21	7	23	30								26	15	9	21	31	28							19,570 cfs
8 ft	21	19	7	21	28			31	30				26	10	8	15	30	14	31						17,640 cfs
7 ft	17	15	3	18	22		31	29	29				26	10	3	13	24	12		31					15,780 cfs
6 ft	15	14	2	17	17		30		28	31			23	8	1	10	21	10	28	30				30	14,000 cfs
5 ft	13	10		14	15	30	25	27	26	30			23	5		10	16	7	23	27	30				12,310 cfs
4 ft	10	8		10	12	29	21	25	22	30		30	22	5		7	13	4	20	27	29				10,700 cfs
3 ft	9	7		7	12	24	16	21	21	25			19	5		2	10	2	18	14	25			29	9,173 cfs
2 ft	6	4			11	18	10	18	20	17		29	15	3			5		12	10	21			28	7,740 cfs
1 ft		2			9	15	8		16	15	30	28	14	3					12	8	17			26	6,401 cfs
0 ft	4				5	14	2	13	16	12	27	22	10	3					7	6	13			24	5,161 cfs
1 ft	2				3	9	1	8	11	8	23	21	9	3					3	4	9	31	30	19	4,025 cfs

	1999												2000												
	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	J.	F.	M.	A.	M.	J.	J.	A.	S.	O.	N.	D.	
2 ft																									52,000 cfs
1 ft																									48,500 cfs
0 ft																									45,500 cfs
9 ft																									42,810 cfs
8 ft																									40,190 cfs
7 ft																									37,630 cfs
6 ft																									35,130 cfs
5 ft																									32,700 cfs
4 ft				30																					30,340 cfs
3 ft	31			29																					28,050 cfs
2 ft				27																					25,820 cfs
1 ft			31	25	31																				23,660 cfs
0 ft		28	29	24	30	30	31																		21,580 cfs
9 ft		26	26		26	29	30																		19,570 cfs
8 ft	30	22	24	22	21		29	31																	17,640 cfs
7 ft	29	20	20	20	17	22	27	30																	15,780 cfs
6 ft		14	14	19	10	20	19	28																	14,000 cfs
5 ft	28		6	17	6	16	12	25																	12,310 cfs
4 ft	27	12	3	15	4	12	4	18	29																10,700 cfs
3 ft	26	10		8	1	10	1	14	24																9,173 cfs
2 ft	25	7		3		7		7	19																7,740 cfs
1 ft	24	5	2			5		5																	6,401 cfs
0 ft	15	3				4		4	17																5,161 cfs
1 ft	11	3				3		3	13																4,025 cfs

Methodology: A consistent method was formed and adopted for evaluation of allocation scenarios. The task schedule in figure 25, page 75, represents the steps taken to complete the recommended allocation plan.

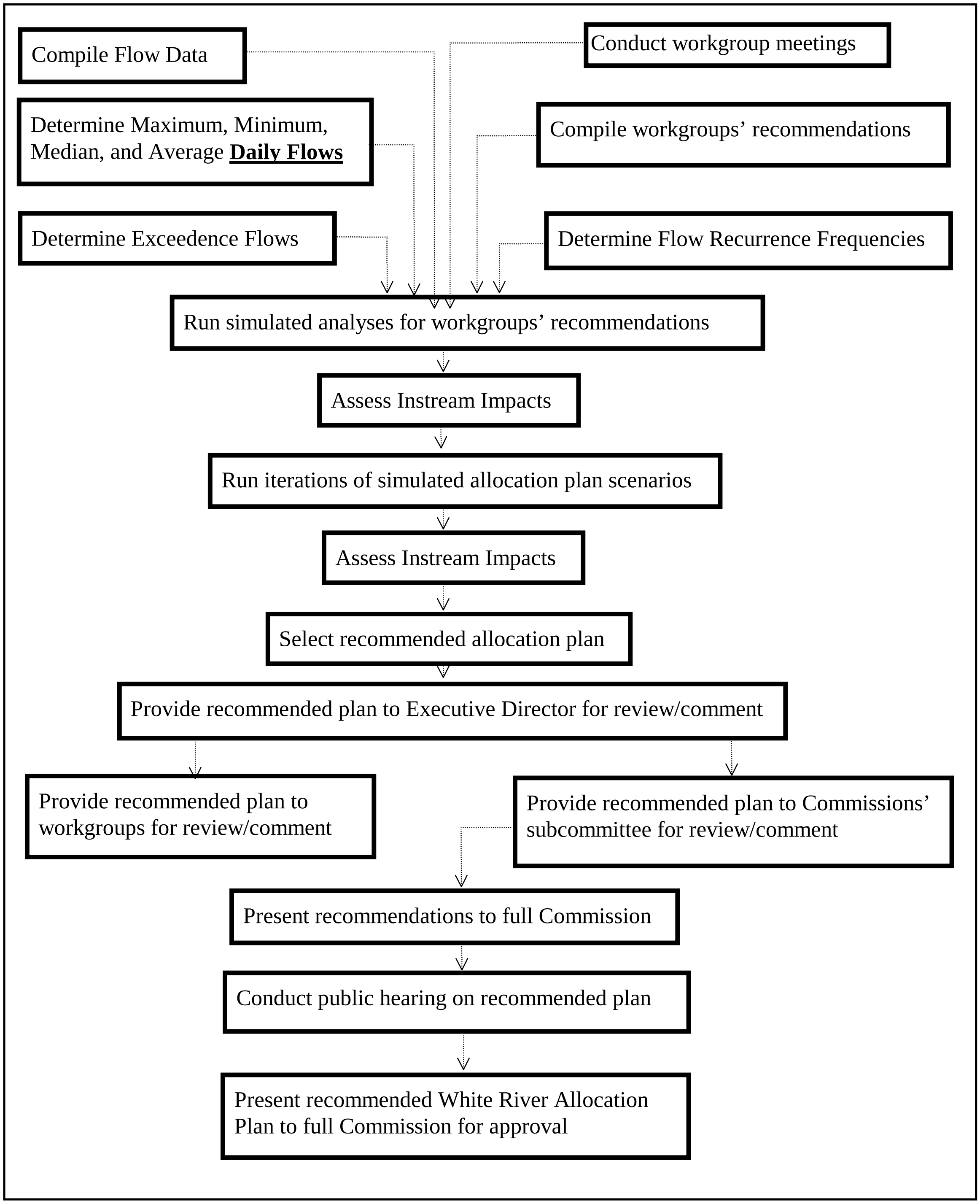


Figure 25. Task Sequencing

Based on data provided from the workgroups' recommendations, several simulated allocation scenarios were analyzed. Questions investigated in all simulations were:

1) How often did simulated allocation levels occur during the period of record?
2) How long would each simulated allocation plan be in effect?
3) What were the anticipated impacts to beneficial uses during the simulated allocations?

After several simulations were evaluated, restrictions on withdrawals were iterated until an equitable distribution of instream impacts was achieved, as determined by the Commission.

ALLOCATION SIMULATIONS

Index of Analyses: Three analyses for each season at the Clarendon and Newport gages are included to compare anticipated impacts during allocation. Each simulation includes gage representations of: 1) workgroup recommendations vs. projected allocation levels; 2) frequency of occurrence for simulated allocations for period of record; 3) allocation levels; and evaluation of anticipated impacts to stream uses during allocation. Various allocation levels are included to depict differences in impacts associated with each simulation. Anticipated impacts during allocation are evaluated for each simulation and are based on current data available, workgroups' recommendations, and professional judgment. An index of the simulations analyzed is included in table 16 A and B, pages 76-77.

Gage	Simulation	Season	Allocation Level	Shut-off Level
Clarendon	#1	Summer	17,500 cfs.	7,125 cfs.
Clarendon	#2	Summer	11,350 cfs.	7,125 cfs.
Clarendon	#3	Summer	9,875 cfs.	5,850 cfs.
Clarendon	#1	Winter	29,900 cfs.	19,200 cfs.
Clarendon	#2	Winter	49,200 cfs.	19,200 cfs.
Clarendon	#3	Winter	19,200 cfs.	11,350 cfs.
Clarendon	#1	Spring	29,000 cfs.	23,300 cfs.
Clarendon	#2	Spring	19,200 cfs.	14,350 cfs.
Clarendon	#3	Spring	25,400 cfs.	17,500 cfs.
Newport	#1	Summer	23,660 cfs	6,401 cfs
Newport	#2	Summer	12,310 cfs	6,401 cfs
Newport	#3	Summer	10,700 cfs	6,401 cfs

Table 16 A. Index of Allocation Simulations

Gage	Simulation	Season	Allocation Level	Shut-off Level
Newport	#1	Winter	23,660 cfs	9,173 cfs
Newport	#2	Winter	15,780 cfs	9,173 cfs
Newport	#3	Winter	23,660 cfs	15,780 cfs
Newport	#1	Spring	25,820 cfs	17,640 cfs
Newport	#2	Spring	23,660 cfs	14,000 cfs
Newport	#3	Spring	19,570 cfs	10,700 cfs
Calico Rock	#1	Summer	2,880 cfs	2,000 cfs
Calico Rock	#1	Winter	4,220 cfs	2,000 cfs
Calico Rock	#1	Spring	5,860 cfs	2,000 cfs

Table 16 B. Simulation Index (cont.)

RECOMMENDED PLAN

INTRODUCTION

The White River is a diverse ecosystem that exhibits many complex and variable flow characteristics. It also presents a valuable economic resource in terms of transportation, recreation, water supply and agricultural irrigation. Those agencies and professionals who have contributed their expertise in drafting this document recognize the many values of this river system, as well as the need to preserve these values for future generations.

Allocation will not maintain the intricate flow patterns that produce the ecological richness of the White River system. Nor will allocation alone ensure the River's resource value to transportation, recreation, water supply, and irrigation. Allocation addresses individual and infrequent low-flow events that affect both instream needs and out-of-stream uses. The recommended plan for allocation will distribute the use of water during low-flow events among lawfully registered users, who must incorporate measures to receive the maximum benefit from their allocation.

There is a need to reevaluate allocation levels whenever a) the plan no longer equitably addresses White River utilization; or, b) significant diversions are shown to negatively impact historic multi-year flow patterns.

WHITE RIVER FLOW PATTERNS

Knowledge of White River flow patterns is important in recognizing the limitations of water allocation and the many variables that influence instream needs and out-of-stream uses. Two general seasonal flow patterns were identified during the technical analysis and are shown in Figure 26 (following page). Historically, flows during winter and spring months are either abundantly high or restrictively low. Typically, high winter and spring flows occurred for two to three consecutive years, followed by one or two years of low spring flow. High seasonal flows occurred at least once every three to four years.

The deviation between high and low flows is not as pronounced during summer months. Typical summer months exhibit low flow cycles similar to the winter and spring cycle, as restrictively low flows occurred at least once every three to four years.

Interpretation: Multi-year winter and spring flow cycles are necessary for successful reproduction and existence of fish and wildlife resources. Navigation shipments depend on these same high seasonal flows to provide passage along the White River. The White River ecosystem has naturally evolved and thrived on the feast or famine conditions associated with the winter and spring flow patterns. Single and double year low-flow conditions are also a part of the multi-year flow cycle. One low-flow year does not indicate future consecutive low-flow years, nor do several high-flow years indicate continued high-flow conditions the following year.

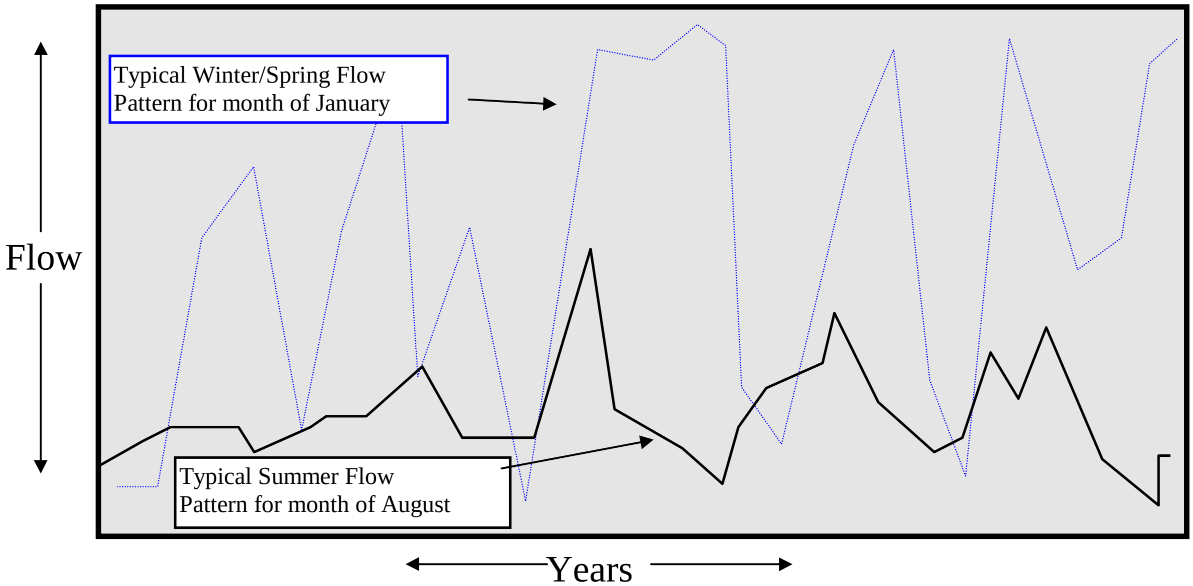


Figure 26. White River Flow Patterns

The current out-of-stream diversion of less than 35 cfs is negligible even during the lowest flow occurrences on record for the White River. It is seasonal variability – and not diversions – that has prompted the current allocation exercise. However, it is important for all users to recognize the potential for future water use conditions and incorporate planning strategies that are based on reasonable use projections.

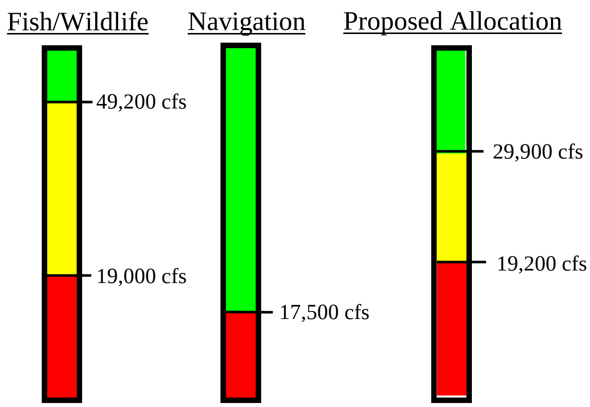
Prolonged and large, single-point withdrawals may or may not alter historic flow patterns of the River over its multi-year flow cycle. Given the highly variable precipitation patterns that occur throughout the White River Basin, predicting impacts of single versus cumulative diversions is difficult without observation of an operational project.

ALLOCATION vs. WORKGROUP RECOMMENDATIONS

This allocation scenario is based on workgroup recommendations from navigation, fish and wildlife, recreation, water quality, agricultural, municipal and industrial interests and flow analyses. In general, workgroup recommendations addressed optimum conditions. This allocation scenario addresses degraded, short-term, single-event low-flow conditions. Proposed allocation levels therefore do not always correspond to workgroup recommendations. The following pages compare workgroup recommendations versus proposed allocation levels, and include staff comments concerning impacts to fish and wildlife, navigation, and out-of-stream diversion interests.

Clarendon Gage

Winter *(December-February)*



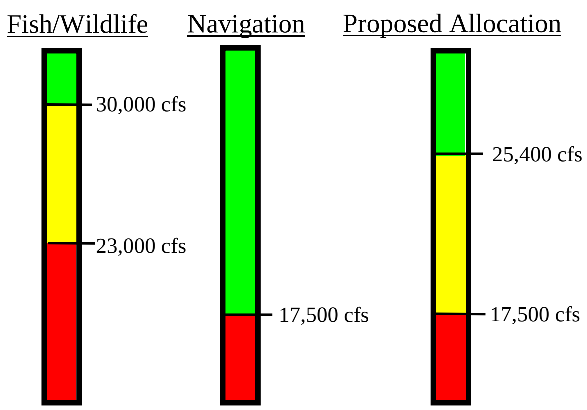
Fish/Wildlife: High winter/spring flows are necessary to replenish fish and wildlife habitat. These high flows naturally occur on average once every three to four years. Fish/wildlife interests acknowledge that irrevocable impacts will not occur at flows below 49,200 cfs during a single season, but they are concerned that chronic conditions would exist if flows were pumped down to these allocation levels every year.

Navigation: Allocation levels are above observed navigation requirements.

Out-of-stream Diversion: There is little to no agricultural demand during these winter months.

Conclusions: Given the historic extreme high and low flow cycles that occur during these months, proposed allocation levels are adequate to protect instream needs during any single season low flow event. If diversion rates from the river ever become great enough to influence multi-year flow patterns, emergency provisions should be implemented to ensure replenishment of fish/wildlife resources.

Spring *(March-May)*



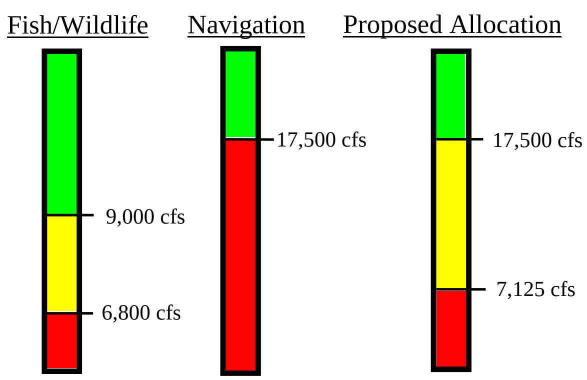
Fish/Wildlife: Same concerns as during the winter season, i.e. that chronic conditions would exist if flows were pumped down to these allocation levels every year. The paddlefish require high flows (>59,000 cfs) to stimulate spawning. These high spring and winter flows occur on average at least once every three to four years. Allocation levels will not threaten survivability of fish and wildlife resources during any single low-flow event.

Navigation: Allocation levels are above observed navigation requirements.

Out-of-stream Diversion: Agricultural water diversions primarily occur between the months of April & September. Shut-off levels occurred an average of 3 days per month over the period of record.

Conclusions: Over the period of record, flows have fallen well below any of the workgroups' recommendations or proposed allocation levels. Allocation will never prevent these naturally occurring "famine" conditions. However, if huge diversions were to occur in the future, allocation would dampen and slow the decreases in river flows. The impacts of current diversions on the river are negligible and too small to measure.

Summer *(June-November)*



Fish/Wildlife: Allocation levels are above recommended fish/wildlife requirements.

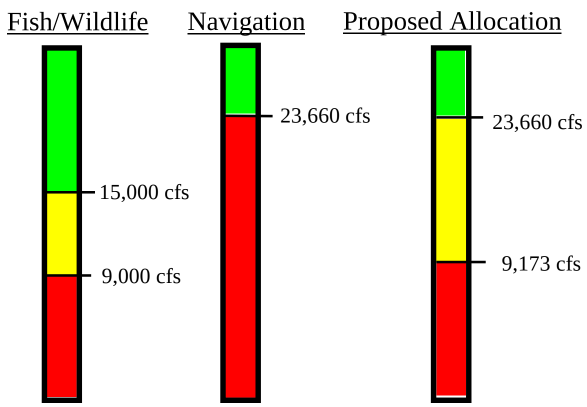
Navigation: Allocation begins at the observed navigation requirement (17,500 cfs).

Out-of-stream Diversion: Restrictions on diversions will begin at 17,500 cfs and will gradually increase as flows decrease. Riparian diverters will be restricted when flows are equal or less than 8,460 cfs.

Conclusions: Records indicate that barge traffic occurs at flows between 17,500 cfs and 11,350 cfs. Barges do not move through the river system at flows below 11,350 cfs. Therefore, allocation provides limited protection for navigation below 17,500 cfs, allows out-of-stream utilization, and benefits fish/wildlife resources. If diversion rates from the river ever become great enough to influence multi-year flow patterns, emergency provisions should be implemented to ensure replenishment of fish/wildlife resources.

Newport Gage

Winter *(December-February)*



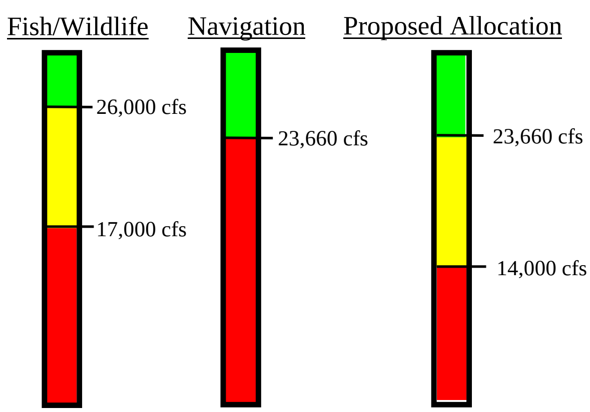
Fish/Wildlife: Allocation levels are above fish and wildlife recommendations.

Navigation: Beginning allocation levels equal observed navigation requirements.

Out-of-stream Diversion: There is little to no agricultural demand during these winter months.

Conclusions: Given the historic extreme high and low flow cycles that occur during these months, proposed allocation levels are adequate to protect fish and wildlife resources. If diversions ever become great enough to influence the high-low flow patterns during these months, emergency provisions could be implemented to further restrict withdrawals for a specified period.

Spring *(March-May)*



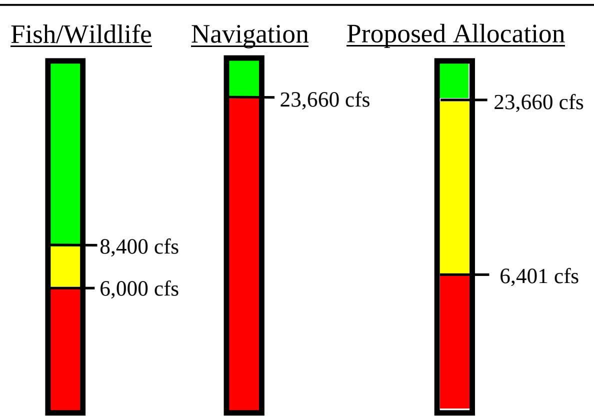
Fish/Wildlife: High winter and spring flows are necessary to replenish fish and wildlife habitat. These high flows naturally occur on average once every three to four years. Fish/wildlife interests acknowledge that irrevocable impacts will not occur at flows below 26,000 cfs during a single season, but they are concerned that chronic conditions would exist if flows were pumped down to these allocation levels every year. Allocation levels will not threaten survivability of fish and wildlife resources during any single low-flow event.

Navigation: Beginning allocation levels equal observed navigation requirements.

Out-of-stream Diversion: Shut-off could have occurred on average 4.3 days per month during the spring season between 1957 and 1994.

Conclusions: Proposed allocation levels are adequate to protect instream needs during any single season low flow event. Emergency provisions should be implemented for a specified time period if diversion rates ever become great enough to affect multi-year flow patterns. Out-of-stream diversion is not unduly restricted.

Summer *(June-November)*



Fish/Wildlife: Allocation levels are above fish and wildlife recommendations.

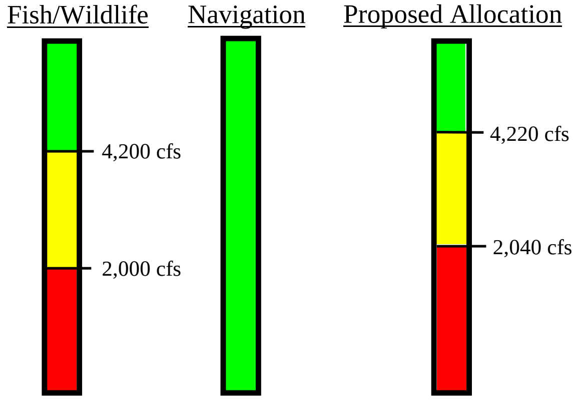
Navigation: Beginning allocation levels equal observed navigation requirements. During the months of July, August, and September, the navigation requirement is equaled or exceeded approximately 4 days a month.

Out-of-stream Diversion: Shut-off levels occurred an average of 3 days per month during the summer.

Conclusions: Given the seasonally low flows that frequently occur during these months, navigation is only possible for a few days a month. Allocation levels cannot protect navigation when it does not occur. Out-of-stream utilization and fish and wildlife needs are benefited with these allocation levels.

Calico Rock Gage

Winter *(December-February)*



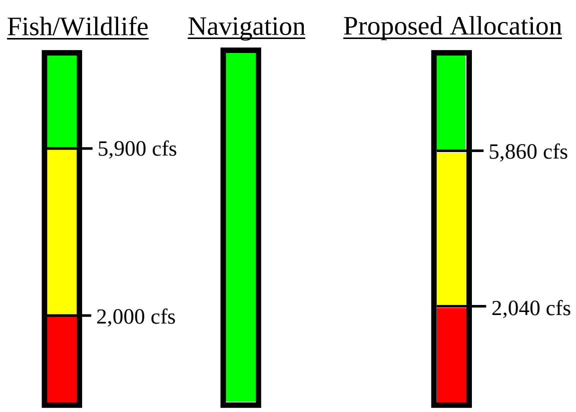
Fish/Wildlife: Allocation levels above fish and wildlife recommendations.

Navigation: Not applicable.

Out-of-stream Diversion: Demand is negligible above Calico Rock, with no projected increase in demand in the future.

Conclusions: Out-of-stream demand is negligible, no navigation requirements, allocation levels are above fish and wildlife recommendations.

Spring *(March-May)*



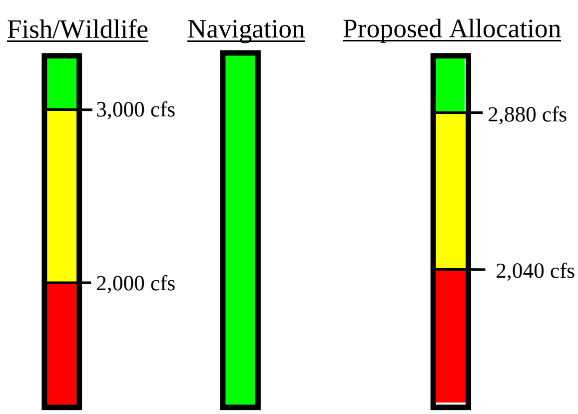
Fish/Wildlife: Allocation levels above fish and wildlife recommendations.

Navigation: Not applicable.

Out-of-stream Diversion: Demand is negligible above Calico Rock, with no projected increase in demand in the future.

Conclusions: Out-of-stream demand is negligible, no navigation requirements, allocation levels are above fish and wildlife recommendations.

Summer *(June-November)*



Fish/Wildlife: Allocation levels above fish and wildlife recommendations.

Navigation: Not applicable.

Out-of-stream Diversion: Demand is negligible above Calico Rock, with no projected increase in demand in the future.

Conclusions: Out-of-stream demand is negligible, no navigation requirements, allocation levels are above fish and wildlife recommendations.

(ALLOCATION vs. WORKGROUP RECOMMENDATIONS - CONTINUED)

1.) Fish and wildlife interests are concerned about significant deviation of historic flow patterns caused by potential large irrigation diversion projects.

- An emergency provision in the plan addresses this concern.

2.) Navigation interests prefer a 365 day-a-year navigation system.

- The allocation plan cannot address this issue, but observed navigation flow requirements were considered in the formulation of proposed allocation levels.

3.) Agricultural interests are concerned that excess water in the river will be locked up and not available for irrigation.

- The allocation plan provides opportunity for out-of-stream utilization. The Memphis District Corps of Engineers analyzed the recommended Allocation Plan and determined the plan would not be detrimental to the proposed White River - Grand Prairie Irrigation Project.

RECOMMENDED ALLOCATION LEVELS

The following recommended plan recognizes instream resource needs and water availability above those needs. The allocation levels reflect shortage conditions based upon analyses of historical White River flow patterns and workgroups' recommendations. Because instream and out-of-stream water needs vary seasonally throughout the year, allocation levels are season-specific. Water allocations were determined for each reach based upon current usage and workgroup recommendations. The recommended plan represents an allocation strategy that balances the needs of many competing uses during times when all water needs can not be optimally met.

Pages 85-93 contain the allocation levels and restrictions for riparian and non-riparian out-of-stream use. On page 84 is an example table showing how to determine allocation restrictions and shut-off levels during each season at each gage. Stage readings on the right side of the table are the governing allocation levels for the green, yellow, and red zones during allocation. The corresponding maximum daily pumping capacities for riparian and non-riparian diversions during allocation are listed to the left of the staff gage in the table.

Example: Allocation Table

11 ft.-10 ft. stage - Individual riparian users are not limited. They can utilize 100% of registered daily use, i.e. no reduction at this stage.

16 ft. - 14 ft. stage - Individual non-riparian users will limit total pumping to 90% of registered daily use or maximum pumping capacity if use has not been registered. (10% reduction)

PUMPING CAPACITY DURING ALLOCATION		Stage/Discharge	
Riparian	**Non-Riparian**		
100%	90%	16 ft.	17,500 cfs
100%	80%		
100%	70%	14 ft.	14,350 cfs
100%	60%		
100%	50%	12 ft.	11,350 cfs
100%	20%	11 ft.	9,875 cfs
50%	0%	10 ft.	8,460 cfs
0%	0%	9 ft.	7,125 cfs

9 ft. and below- the Shut-off level for all diversions.

White River Allocation Plan

Clarendon Gage

SUMMER (June 1st - November 30th)

Registered riparian and non-riparian withdrawal rates will be adjusted during shortage conditions according to the table below. (Example: At 16 ft. stage, individual non-riparian users will limit total pumping to 90% of the registered daily withdrawal rate.)

PUMPING CAPACITY DURING ALLOCATION		Stage/Discharge	
Riparian	Non-Riparian	Stage	Discharge
100%	90%	16 ft.	17,500 cfs
100%	80%	15 ft.	15,900 cfs
100%	70%	14 ft.	14,350 cfs
100%	50%	12 ft.	11,350 cfs
100%	20%	11 ft.	9,875 cfs
100%	0%	10.5 ft.	9,650 cfs
50%	0%	10 ft.	8,460 cfs
0%	0%	9 ft.	7,125 cfs

The table below contains data compiled from flow frequency analyses and represent occurrence values that were averaged for the period 1963-1997. Data shown below is for illustration purposes only and does not guarantee specific allocation levels during any single year. (Example: During the month of August, riparian diversions would have been shut-off less than one day on average during the period of 1963-1997.)

Average Number of Days per Month (1963-1997) with Reduced Withdrawal Rates

Month	Riparian		Non-Riparian					
Pumping Rate >	50%	Shut-off	90 %	80%	70%	50%	20%	Shut-off
June	<1	0	1.5	1.6	3.1	1.4	<1	<1
July	<1	0	2.6	2.8	6.8	2.5	<1	1.2
August	1.5	<1	2.7	3.5	7.3	3.1	<1	3.7
September	2.1	2.0	1.6	2.4	7.7	3.8	<1	6.9
October	2.9	3.7	2.0	2.3	5.4	4.0	<1	10.2
November	2.2	2.7	1.4	1.8	6.5	2.6	<1	7.5

White River Allocation Plan

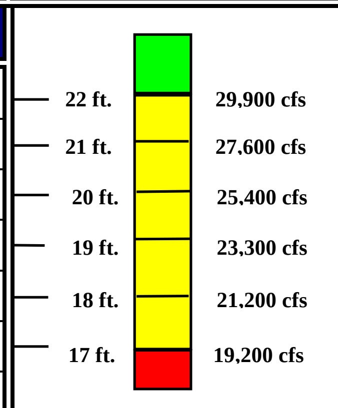
Clarendon Gage

WINTER (December 1st - February 28th)

Registered riparian and non-riparian withdrawals rates will be adjusted during shortage conditions according to the table below. (Example: At 20 ft. stage, individual non-riparian users will limit total pumping to 70% of the registered daily withdrawal rate.)

PUMPING CAPACITY DURING ALLOCATION	
Riparian	**Non-Riparian**
100%	90%
100%	80%
100%	70%
100%	50%
50%	0%
0%	0%

Stage/Discharge



The table below contains data compiled from flow frequency analyses and represent occurrence values that were averaged for the period 1963-1997. Data shown below is for illustration purposes only and does not guarantee specific allocation levels during any single year. (Example: During the month of February non-riparian diversion would have been shut off 7.3 day on average during the period of 1963-1997.)

Average Number of Days per Month (1963-1997) with Reduced Withdrawal Rates							
Month	Riparian		Non-Riparian				
Pumping Rate >	50%	Shut-off	90 %	80%	70%	50%	Shut-off
December	<1	11	1.2	<1	1.2	1.1	11.7
January	<1	7.8	<1	1.5	1.5	1.1	8.5
February	1.4	7.4	<1	1.3	<1	<1	8.8

White River Allocation Plan

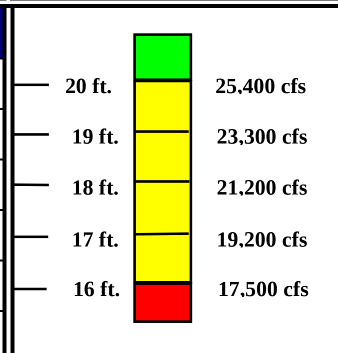
Clarendon Gage

SPRING **(March 1st - May 31st)**

Registered riparian and non-riparian withdrawal rates will be adjusted during shortage conditions according to the table below. (Example: At 19 ft. stage, individual non-riparian users will limit total pumping to 70% of the registered daily withdrawal rate.)

PUMPING CAPACITY DURING ALLOCATION	
Riparian	**Non-Riparian**
100%	90%
100%	70%
100%	50%
50%	0%
0%	0%

Stage/Discharge



The table below contains data compiled from flow frequency analyses and represent occurrence values that were averaged for the period 1963-1997. Data shown below is for illustration purposes only and does not guarantee specific allocation levels during any single year. (Example: During the month of May, individual non-riparian diversions would have been shut off 5.4 days on average during the period of 1963-1997.)

Average Number of Days per Month (1963-1997) with Reduced Withdrawal Rates						
Month	Riparian		Non-Riparian			
Pumping Rate >	50%	Shut-off	90%	70%	50%	Shut-off
March	<1	2.5	1.2	<1	<1	3.2
April	1.1	3.5	<1	<1	<1	4.5
May	1.4	4	<1	<1	1.4	5.4

White River Allocation Plan

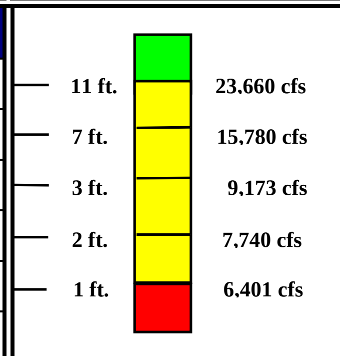
Newport Gage

SUMMER (June 1st - November 30th)

Registered riparian and non-riparian withdrawals rates will be adjusted during shortage conditions according to the table below. (Example: At an 11 ft. stage, individual non-riparian users will limit total pumping to 90% of the registered daily withdrawal rate.)

PUMPING CAPACITY DURING ALLOCATION	
Riparian	Non-Riparian
100%	90%
100%	70%
100%	50%
50%	0%
0%	0%

Stage/Discharge



The table below contains data compiled from flow frequency analyses and represent occurrence values that were averaged for the period 1955-1998. Data shown below is for illustration purposes only and does not guarantee specific allocation levels during any single year. (Example: During the month of August, non-riparian diversion would have been shut off 1.7 days on average during the period of 1955-1998.)

Average Number of Days per Month (1955-1998) with Reduced Withdrawal Rates						
Month	Riparian		Non-Riparian			
Pumping Rate >	50%	Shut-off	90%	70%	50%	Shut-off
June	<1	<1	7.6	9.7	1.5	1.0
July	1.4	<1	5.8	13.0	3.2	1.9
August	3.1	1.6	3.8	13.3	4.3	4.7
September	4.8	4.3	2.8	10.9	5.0	9.0
October	5.0	5.5	2.8	12.3	3.7	10.5
November	4.2	4.3	3.5	7.2	4.1	8.5

White River Allocation Plan

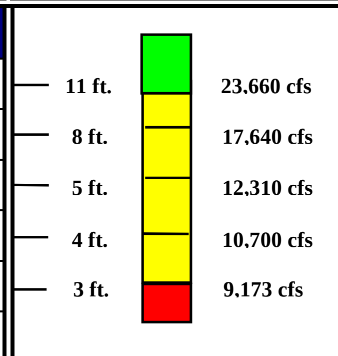
Newport Gage

WINTER (December 1st - February 28th)

Registered riparian and non-riparian withdrawals rates will be adjusted during shortage conditions according to the table below. (Example: At an 11 ft. stage individual non-riparian users will limit total pumping to 90% of the registered daily withdrawal rate.)

PUMPING CAPACITY DURING ALLOCATION	
Riparian	Non-Riparian
100%	90%
100%	70%
100%	50%
50%	0%
0%	0%

Stage/Discharge



The table below contains data compiled from flow frequency analyses and represent occurrence values that were averaged for the period 1955-1998. Data shown below is for illustration purposes only and does not guarantee specific allocation levels during any single year. (Example: During the month of February non-riparian diversions would have been shut-off 4.6 days on average during the period of 1955-1998.)

Average Number of Days per Month (1955-1998) with Reduced Withdrawal Rates

Month	Riparian		Non-Riparian			
Pumping Rate >	50%	Shut-off	90%	70%	50%	Shut-off
December	2.4	7.6	3.1	2.7	1.6	10.0
January	1.3	5.5	4.6	5.0	1.8	6.9
February	1.5	3.2	4.4	4.0	1.8	4.6

White River Allocation Plan

Newport Gage

SPRING (March 1st - May 31st)

Registered riparian and non-riparian withdrawals rates will be adjusted during shortage conditions according to the table below. (Example: At an 11 ft. stage individual non-riparian users will limit total pumping to 90% of the registered daily withdrawal rate.)

PUMPING CAPACITY DURING ALLOCATION		Stage/Discharge	
Riparian	Non-Riparian		
100%	90%	11 ft.	23,660 cfs
100%	80%	10 ft.	21,580 cfs
100%	70%	9 ft.	19,570 cfs
100%	50%	8 ft.	17,640 cfs
50%	0%	7 ft.	15,780 cfs
0%	0%	6 ft.	14,000 cfs

The table below contains data compiled from flow frequency analyses and represent occurrence values that were averaged for the period 1955-1998. Data shown below is for illustration purposes only and does not guarantee specific allocation levels during any single year. (Example: During the month of March, non-riparian diversions would have been shut-off 5.5 days on average during the period of 1955-1998.)

Average Number of Days per Month (1955-1998) with Reduced Withdrawal Rates

Month	Riparian		Non-Riparian			
Pumping Rate >	50%	Shut-off	90 %	70%	50%	Shut-off
March	1.1	4.4	3.4	1.9	1.6	5.5
April	1.4	4.5	2.4	1.3	1.1	5.9
May	2.3	4.9	2.4	1.3	1.9	7.2

White River Allocation Plan

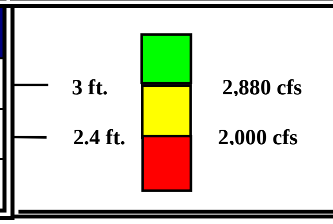
Calico Rock Gage

SUMMER (June 1st - November 30th)

Registered riparian and non-riparian withdrawals rates will be adjusted during shortage conditions according to the table below. (Example: At 3 ft. stage, individual non-riparian users will limit total pumping to 50% of the registered daily withdrawal rate.)

PUMPING CAPACITY DURING ALLOCATION	
Riparian	Non-Riparian
50%	0%
0%	0%

Stage/Discharge



The table below contains data compiled from flow frequency analyses and represent occurrence values that were averaged for the period 1955-1998. Data shown below is for illustration purposes only and does not guarantee specific allocation levels during any single year. (Example: During the month of August, non-riparian diversion would have been shut-off 4.1 days on average during the period of 1955-1998.)

Average Number of Days per Month (1955-1998) with Reduced Withdrawal Rates

Month	Riparian		Non-Riparian
Pumping Rate >	50%	Shut-off	Shut-off
June	1.7	<1	2.4
July	2.1	<1	3.0
August	2.3	1.8	4.1
September	3.9	3.7	7.6
October	4.0	4.6	8.5
November	2.9	4.5	7.4

White River Allocation Plan

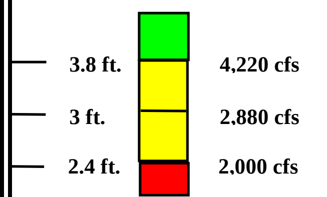
Calico Rock Gage

WINTER (December 1st - February 28th)

Registered riparian and non-riparian withdrawals rates will be adjusted during shortage conditions according to the table below. (Example: At a 3.8 foot stage, individual non-riparian users will limit total pumping to 50% of the registered daily withdrawal rate.)

PUMPING CAPACITY DURING ALLOCATION	
Riparian	Non-Riparian
100%	50%
50%	0%
0%	0%

Stage/Discharge



The table below contains data compiled from flow frequency analyses and represent occurrence values that were averaged for the period 1955-1998. Data shown below is for illustration purposes only and does not guarantee specific allocation levels during any single year. (Example: During the month of February, non-riparian diversions would have been shut off 1.4 days on average during the period of 1955-1998.)

Average Number of Days per Month (1955-1998) with Reduced Withdrawal Rates				
Month	Riparian		Non-Riparian	
Pumping Rate >	50%	Shut-off	50%	Shut-off
December	2.4	3.6	2.8	6.0
January	2.4	2.6	2.9	5.0
February	2.1	1.3	2.9	3.4

White River Allocation Plan

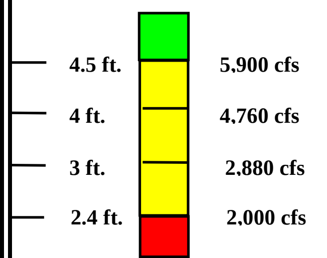
Calico Rock Gage

SPRING (March 1st - May 31st)

Registered riparian and non-riparian withdrawals rates will be adjusted during shortage conditions according to the table below. (Example: At 4.5 ft. stage, individual non-riparian users will limit total pumping to 50% of the registered daily withdrawal rate.)

PUMPING CAPACITY DURING ALLOCATION	
Riparian	**Non-Riparian**
100%	50%
100%	50%
50%	0%
0%	0%

Stage/Discharge



The table below contains data compiled from flow frequency analyses and represent occurrence values that were averaged for the period 1955-1998. Data shown below is for illustration purposes only and does not guarantee specific allocation levels during any single year. (Example: During the month of March, non-riparian diversions would have been shut off 2 days on average during the period of 1955-1998.)

Average Number of Days per Month (1955-1998) with Reduced Withdrawal Rates				
Month	Riparian		Non-Riparian	
Pumping Rate >	50%	Shut-off	50%	Shut-off
March	1.4	<1	5.7	2.0
April	<1	<1	5.3	1.7
May	1.5	<1	5.4	2.1

IMPLEMENTATION RECOMMENDATIONS

Emergency Provision

- An emergency provision for modification of the allocation plan is included in Sections 313.1 and 313.2 of Title III of the ASWCC *Rules for the Utilization of Surface Water*.

White River Flow Data

- *ASWCC staff will provide a White River Flow Data report to the full Commission on an annual basis.* The staff will report any unusual deviation from observed historical White River flow patterns or hydrologic trends that may affect "shortage conditions". The staff will provide this information to Corps of Engineers' White River Coordinating Committee.

Public Education

- *Conduct public education and outreach on the development of the White River Allocation Plan and its significance to future utilization of the White River.* A presentation describing the process and steps undertaken to develop the White River Allocation Plan can increase public awareness and understanding of resources management issues.

Plan Activation

- *The White River Allocation Plan should be activated when cumulative diversions from the White River (Bull Shoals to Mississippi River) equal or exceed 200 cfs.* Current diversions subject to allocation are less than 35 cfs and are insignificant.
- *The current plan will remain in effect for as long as conditions on the White River are accurately depicted in the plan as determined by the Executive Director.*

PENALTIES & ENFORCEMENT

Arkansas Code Annotated §15-22-204 sets forth penalties for violations of Subchapter 2 of Chapter 22 of the Code. Violations of the subchapter are considered misdemeanors with penalties of up to six months in jail, a maximum fine of $10,000, or both. For a continuing offense, each day during which the offense is committed can be considered a separate violation.

In addition to criminal penalties, the ASWCC may enforce its regulations by revocation of permits, suspension from programs, lawsuits for damages and injunctive relief, or by civil penalties of up to $10,000.

Appendix A . . . . . Exceedence Flows & Estimated Water Depths

Appendix B . . . . . River Freight Traffic Volumes

WHITE RIVER- NEWPORT,AR.
PERIOD OF RECORD 1965-1992 (Gage 0-194.09)

STAGE (FT)	ELEVATION (NGVD)	FLOW (CFS)	PERCENT OF TIME EQUAL OR EXCEEDED	MINIMUM DEPTHS WITH AUTHORIZED O & M (FT)	APPROXIMATE WATER DEPTHS WITH EXISTING O & M (FT)	MINIMUM WATER DEPTHS WITH PROPOSED PROJECT (FT)
-1.0	193.1	4,025	99.5	< 4.5	3.0	< 9.0
.0	194.1	5,161	97.5	< 4.5	4.0	< 9.0
1.0	195.1	6,401	93.4	< 4.5	5.0	9.0
2.0	196.1	7,740	87.9	< 4.5	6.0	10.0
3.0	197.1	9,173	80.5	< 4.5	7.0	11.0
4.0	198.1	10,700	73.0	4.5	8.0	12.0
5.0	199.1	12,310	65.1	4.5	9.0	13.0
6.0	200.1	14,000	58.6	4.5	10.0	14.0
7.0	201.1	15,780	52.3	4.5	11.0	15.0
8.0	202.1	17,640	47.3	4.5	12.0	16.0
9.0	203.1	19,570	43.0	4.5	13.0	17.0
10.0	204.1	21,580	38.9	4.5	14.0	18.0
11.0	205.1	23,660	35.3	4.5	15.0	19.0
12.0	206.1	25,820	30.5	4.5	16.0	20.0
13.0	207.1	28,050	27.1	4.5	17.0	21.0
14.0	208.1	30,340	24.4	4.5	18.0	22.0
15.0	209.1	32,700	22.6	4.5	19.0	23.0
16.0	210.1	35,130	21.0	4.5	20.0	24.0
17.0	211.1	37,630	19.5	4.5	21.0	25.0
18.0	212.1	40,190	17.2	4.5	22.0	26.0
19.0	213.1	42,810	14.9	4.5	23.0	27.0
20.0	214.1	45,500	13.0	4.5	24.0	28.0
21.0	215.1	48,500	10.4	4.5	25.0	29.0
22.0	216.1	52,000	7.1	4.5	26.0	30.0
23.0	217.1	56,500	5.2	4.5	27.0	31.0
24.0	218.1	61,000	3.9	4.5	28.0	32.0
25.0	219.1	67,000	2.7	4.5	29.0	33.0
26.0	220.1	74,000	1.8	4.5	30.0	34.0

Newport gaging station exceedence flows & estimated depths data.

WHITE RIVER- AUGUSTA, AR.
PERIOD OF RECORD 1965-1981

STAGE (FT)	ELEVATION (NGVD)	FLOW (CFS)	PERCENT OF TIME EQUAL OR EXCEEDED	MINIMUM DEPTHS WITH AUTHORIZED O & M (FT)	APPROXIMATE WATER DEPTHS WITH EXISTING O & M (FT)	MINIMUM WATER DEPTHS WITH PROPOSED PROJECT (FT)
11.0	180.9	4,258	99.4	5.0	4.0	< 9.0
12.0	181.9	5,722	96.2	5.0	5.0	< 9.0
13.0	182.9	7,055	91.9	5.0	6.0	9.0
14.0	183.9	8,667	84.8	5.0	7.0	10.0
15.0	184.9	10,150	77.5	8.0	8.0	11.0
16.0	185.9	11,603	70.4	8.0	9.0	12.0
17.0	186.9	13,196	63.4	8.0	10.0	13.0
18.0	187.9	14,968	57.1	8.0	11.0	14.0
19.0	188.9	16,651	51.8	8.0	12.0	15.0
20.0	189.9	18,725	46.7	8.0	13.0	16.0
21.0	190.9	20,778	42.2	8.0	14.0	17.0
22.0	191.9	22,650	38.6	8.0	15.0	18.0
23.0	192.9	24,607	35.1	8.0	16.0	19.0
24.0	193.9	26,154	31.9	8.0	17.0	20.0
25.0	194.9	28,441	28.2	8.0	18.0	21.0
26.0	195.9	32,230	24.0	8.0	19.0	22.0
27.0	196.9	35,253	21.8	8.0	20.0	23.0
28.0	197.9	37,931	20.1	8.0	21.0	24.0
29.0	198.9	40,566	18.1	8.0	22.0	25.0
30.0	199.9	44,671	14.7	8.0	23.0	26.0
31.0	200.9	52,616	8.5	8.0	24.0	27.0
32.0	201.9	67,974	3.2	8.0	25.0	28.0
33.0	202.9	85,365	1.3	8.0	26.0	29.0

Augusta gaging station exceedence flows & estimated depths data.

WHITE RIVER- GEORGETOWN, AR.

PERIOD OF RECORD 1965-1981 (Gage 0-170.08)

STAGE (FT)	ELEVATION (NGVD)	FLOW (CFS)	PERCENT OF TIME EQUAL OR EXCEEDED	MINIMUM DEPTHS WITH AUTHORIZED O & M (FT)	APPROXIMATE WATER DEPTHS WITH EXISTING O & M (FT)	MINIMUM WATER DEPTHS WITH PROPOSED PROJECT (FT)
-1.0	169.1	4,211	99.7	5.0	4.0	< 9.0
.0	170.1	5,700	97.7	5.0	5.0	< 9.0
1.0	171.1	7,129	94.5	5.0	6.0	9.0
2.0	172.1	8,656	88.9	5.0	7.0	10.0
3.0	173.1	10,107	82.5	8.0	8.0	11.0
4.0	174.1	11,614	75.5	8.0	9.0	12.0
5.0	175.1	13,201	68.3	8.0	10.0	13.0
6.0	176.1	15,030	61.3	8.0	11.0	14.0
7.0	177.1	17,011	55.6	8.0	12.0	15.0
8.0	178.1	19,511	49.8	8.0	13.0	16.0
9.0	179.1	21,518	45.5	8.0	14.0	17.0
10.0	180.1	23,382	41.6	8.0	15.0	18.0
11.0	181.1	25,482	37.8	8.0	16.0	19.0
12.0	182.1	27,644	34.1	8.0	17.0	20.0
13.0	183.1	29,583	30.7	8.0	18.0	21.0
14.0	184.1	32,166	27.5	8.0	19.0	22.0
15.0	185.1	35,387	24.5	8.0	20.0	23.0
16.0	186.1	38,889	21.9	8.0	21.0	24.0
17.0	187.1	41,708	20.1	8.0	22.0	25.0
18.0	188.1	45,418	17.4	8.0	23.0	26.0
19.0	189.1	48,773	14.8	8.0	24.0	27.0
20.0	190.1	54,584	11.2	8.0	25.0	28.0
21.0	191.1	60,324	7.7	8.0	26.0	29.0
22.0	192.1	72,222	4.2	8.0	27.0	30.0
23.0	193.1	83,792	2.3	8.0	28.0	31.0
24.0	194.1	96,517	1.2	8.0	29.0	32.0

Georgetown gaging station exceedence flows & estimated depths data.

WHITE RIVER- <u>DES ARC, AR.</u>
PERIOD OF RECORD 1965-1992 (Gage 0-159.87)

STAGE (FT)	ELEVATION (NGVD)	FLOW (CFS)	PERCENT OF TIME EQUAL OR EXCEEDED	MINIMUM DEPTHS WITH AUTHORIZED O & M (FT)	APPROXIMATE WATER DEPTHS WITH EXISTING O & M (FT)	MINIMUM WATER DEPTHS WITH PROPOSED PROJECT (FT)
2.0	161.9	5,699	98.2	5.0	4.0	< 9.0
3.0	162.9	6,938	95.7	5.0	5.0	< 9.0
4.0	163.9	8,241	91.8	5.0	6.0	9.0
5.0	164.9	9,751	85.9	5.0	7.0	10.0
6.0	165.9	11,236	79.3	8.0	8.0	11.0
7.0	166.9	12,593	72.9	8.0	9.0	12.0
8.0	167.9	14,115	66.5	8.0	10.0	13.0
9.0	168.9	15,618	61.1	8.0	11.0	14.0
10.0	169.9	17,244	56.7	8.0	12.0	15.0
11.0	170.9	18,788	53.0	8.0	13.0	16.0
12.0	171.9	20,665	49.3	8.0	14.0	17.0
13.0	172.9	22,341	45.8	8.0	15.0	18.0
14.0	173.9	24,045	42.3	8.0	16.0	19.0
15.0	174.9	26,588	37.6	8.0	17.0	20.0
16.0	175.9	28,939	33.7	8.0	18.0	21.0
17.0	176.9	31,118	30.2	8.0	19.0	22.0
18.0	177.9	34,118	27.0	8.0	20.0	23.0
19.0	178.9	36,869	24.5	8.0	21.0	24.0
20.0	179.9	40,758	21.8	8.0	22.0	25.0
21.0	180.9	45,049	18.9	8.0	23.0	26.0
22.0	181.9	50,911	14.6	8.0	24.0	27.0
23.0	182.9	56,875	11.1	8.0	25.0	28.0
25.0	184.9	75,294	4.4	8.0	27.0	30.0
26.0	185.9	87,868	2.3	8.0	28.0	31.0
27.0	186.9	102,635	1.1	8.0	29.0	32.0

Des Arc gaging station exceedence flows & estimated depths data.

WHITE RIVER- DEVALLS BLUFF, AR.
PERIOD OF RECORD 1965-1992 (Gage 0-152.96)

STAGE (FT)	ELEVATION (NGVD)	FLOW (CFS)	PERCENT OF TIME EQUAL OR EXCEEDED	MINIMUM DEPTHS WITH AUTHORIZED O & M (FT)	APPROXIMATE WATER DEPTHS WITH EXISTING O & M (FT)	MINIMUM WATER DEPTHS WITH PROPOSED PROJECT (FT)
2.0	155.0	5,390	98.9	5.0	2.0	< 9.0
3.0	156.0	6,630	96.5	5.0	3.0	< 9.0
4.0	157.0	7,860	93.6	5.0	4.0	9.0
5.0	158.0	9,080	89.2	5.0	5.0	10.0
6.0	159.0	10,300	84.1	5.0	6.0	11.0
7.0	160.0	11,500	78.9	5.0	7.0	12.0
8.0	161.0	12,700	73.3	8.0	8.0	13.0
9.0	162.0	13,800	68.5	8.0	9.0	14.0
10.0	163.0	15,000	64.0	8.0	10.0	15.0
11.0	164.0	16,400	59.4	8.0	11.0	16.0
12.0	165.0	17,900	55.6	8.0	12.0	17.0
13.0	166.0	19,800	51.3	8.0	13.0	18.0
14.0	167.0	21,800	47.5	8.0	14.0	19.0
15.0	168.0	24,200	42.7	8.0	15.0	20.0
16.0	169.0	26,800	37.9	8.0	16.0	21.0
17.0	170.0	30,000	32.5	8.0	17.0	22.0
18.0	171.0	34,000	27.4	8.0	18.0	23.0
19.0	172.0	38,300	23.9	8.0	19.0	24.0
20.0	173.0	43,300	20.5	8.0	20.0	25.0
21.0	174.0	49,800	15.9	8.0	21.0	26.0
22.0	175.0	58,000	10.8	8.0	22.0	27.0
23.0	176.0	69,600	6.0	8.0	23.0	28.0
24.0	177.0	82,900	3.3	8.0	24.0	29.0
25.0	178.0	98,100	1.5	8.0	25.0	30.0

(1) Exceedence percentages for associated flows were developed using data computed at Clarendon and Newport due to insufficient daily records at DeValls Bluff.

DeValls Bluff gaging station exceedence flows & estimated depths data.

WHITE RIVER- CLARENDON, AR.
PERIOD OF RECORD 1965-1992 (Gage 0-139.91)

STAGE (FT)	ELEVATION (NGVD)	FLOW (CFS)	PERCENT OF TIME EQUAL OR EXCEEDED	MINIMUM DEPTHS WITH AUTHORIZED O & M (FT)	APPROXIMATE WATER DEPTHS WITH EXISTING O & M (FT)	MINIMUM WATER DEPTHS WITH PROPOSED PROJECT (FT)
6.0	145.9	3,650	100.0	5.0	2.0	< 9
7.0	146.9	4,700	99.8	5.0	3.0	< 9
8.0	147.9	5,850	99.1	5.0	4.0	< 9
9.0	148.9	7,125	97.1	5.0	5.0	< 9
10.0	149.9	8,460	94.5	5.0	6.0	< 9
11.0	150.9	9,875	89.9	5.0	7.0	9.0
12.0	151.9	11,350	84.2	8.0	8.0	10.0
13.0	152.9	12,850	78.1	8.0	9.0	11.0
14.0	153.9	14,350	71.1	8.0	10.0	12.0
15.0	154.9	15,900	65.5	8.0	11.0	13.0
16.0	155.9	17,500	60.4	8.0	12.0	14.0
17.0	156.9	19,200	56.7	8.0	13.0	15.0
18.0	157.9	21,200	52.7	8.0	14.0	16.0
19.0	158.9	23,300	49.4	8.0	15.0	17.0
20.0	159.9	25,400	45.5	8.0	16.0	18.0
21.0	160.9	27,600	41.1	8.0	17.0	19.0
22.0	161.9	29,900	37.2	8.0	18.0	20.0
23.0	162.9	32,500	33.2	8.0	19.0	21.0
24.0	163.9	35,900	28.9	8.0	20.0	22.0
25.0	164.9	41,900	24.4	8.0	21.0	23.0
26.0	165.9	49,200	19.4	8.0	22.0	24.0
27.0	166.9	58,000	13.7	8.0	23.0	25.0
28.0	167.9	69,800	8.1	8.0	24.0	26.0
29.0	168.9	85,500	4.6	8.0	25.0	27.0
30.0	169.9	102,000	2.1	8.0	26.0	28.0
31.0	170.9	120,000	.9	8.0	27.0	29.0

Clarendon gaging station exceedence flows & estimated depths data.

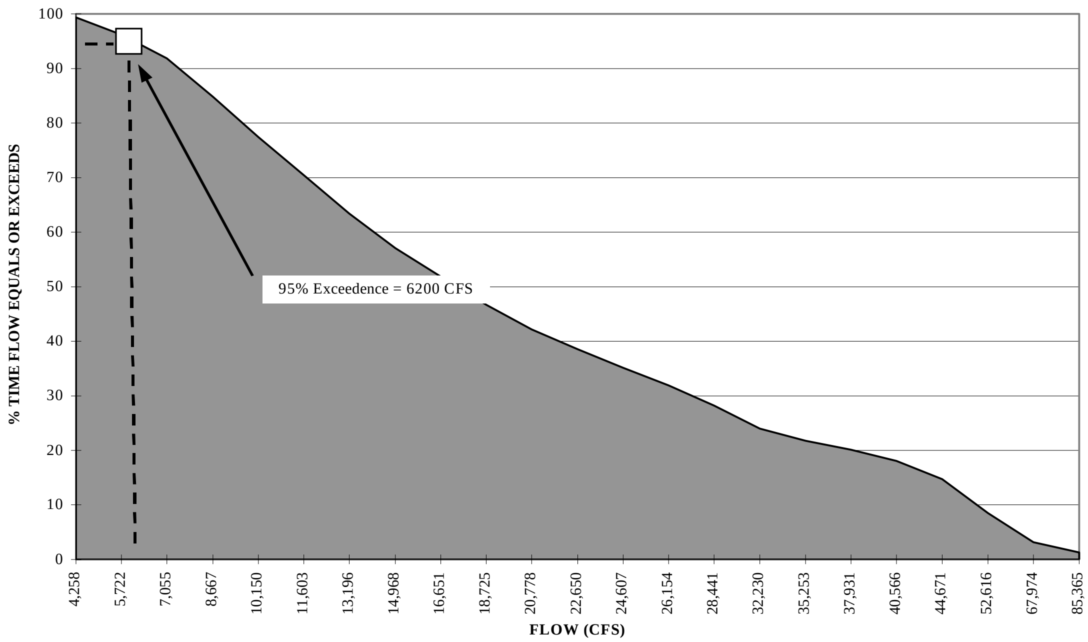
WHITE RIVER- ST. CHARLES, AR.
PERIOD OF RECORD 1965-1983 (Gage 0-129.95)

STAGE (FT)	ELEVATION (NGVD)	FLOW (CFS)	PERCENT OF TIME EQUAL OR EXCEEDED	MINIMUM DEPTHS WITH AUTHORIZED O & M (FT)	APPROXIMATE WATER DEPTHS WITH EXISTING O & M (FT)	MINIMUM WATER DEPTHS WITH PROPOSED PROJECT (FT)
7.0	137.0	5,961	99.1	5.0	3.0	< 9.0
8.0	138.0	7,427	96.6	5.0	4.0	< 9.0
9.0	139.0	8,988	93.1	5.0	5.0	9.0
10.0	140.0	10,457	88.1	5.0	6.0	10.0
11.0	141.0	12,057	81.9	5.0	7.0	11.0
12.0	142.0	13,539	75.5	8.0	8.0	12.0
13.0	143.0	15,159	68.7	8.0	9.0	13.0
14.0	144.0	16,989	62.6	8.0	10.0	14.0
15.0	145.0	19,244	57.0	8.0	11.0	15.0
16.0	146.0	21,616	52.4	8.0	12.0	16.0
17.0	147.0	23,944	48.7	8.0	13.0	17.0
18.0	148.0	25,828	45.2	8.0	14.0	18.0
19.0	149.0	27,732	41.4	8.0	15.0	19.0
20.0	150.0	29,846	37.8	8.0	16.0	20.0
21.0	151.0	32,709	33.4	8.0	17.0	21.0
22.0	152.0	35,711	29.6	8.0	18.0	22.0
23.0	153.0	39,365	26.6	8.0	19.0	23.0
24.0	154.0	44,576	22.9	8.0	20.0	24.0
25.0	155.0	54,311	16.4	8.0	21.0	25.0
26.0	156.0	69,585	8.6	8.0	22.0	26.0
27.0	157.0	84,914	4.9	8.0	23.0	27.0
28.0	158.0	93,941	3.5	8.0	24.0	28.0
29.0	159.0	99,027	2.7	8.0	25.0	29.0
30.0	160.0	104,539	2.0	8.0	26.0	30.0

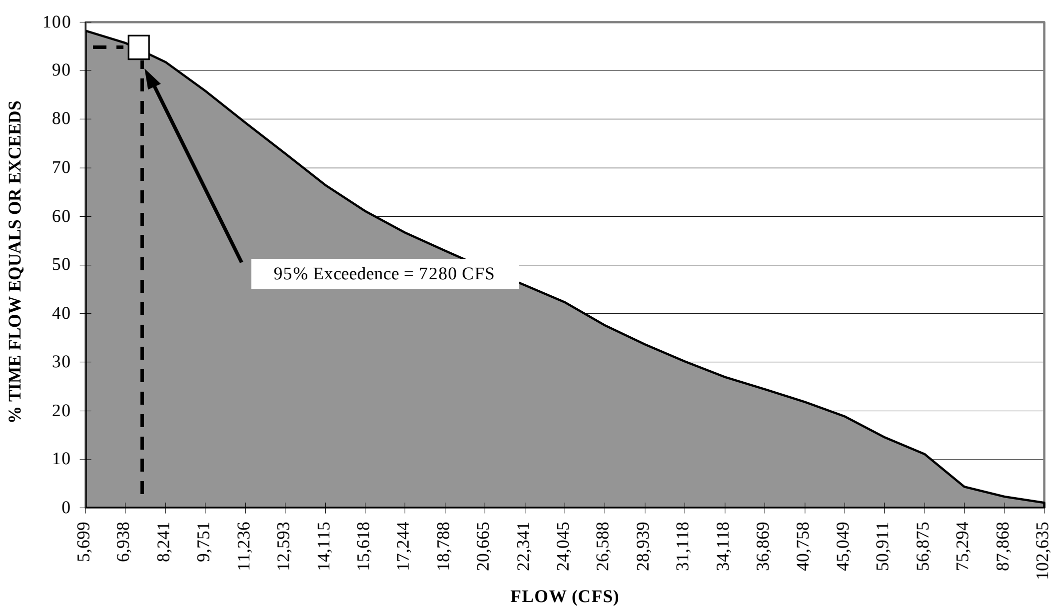
St. Charles gaging station exceedence flows & estimated depths data.

Exceedence Flows:

WHITE RIVER -AUGUSTA, AR
PERIOD OF RECORD (1965-1981)
Exceedence Flows



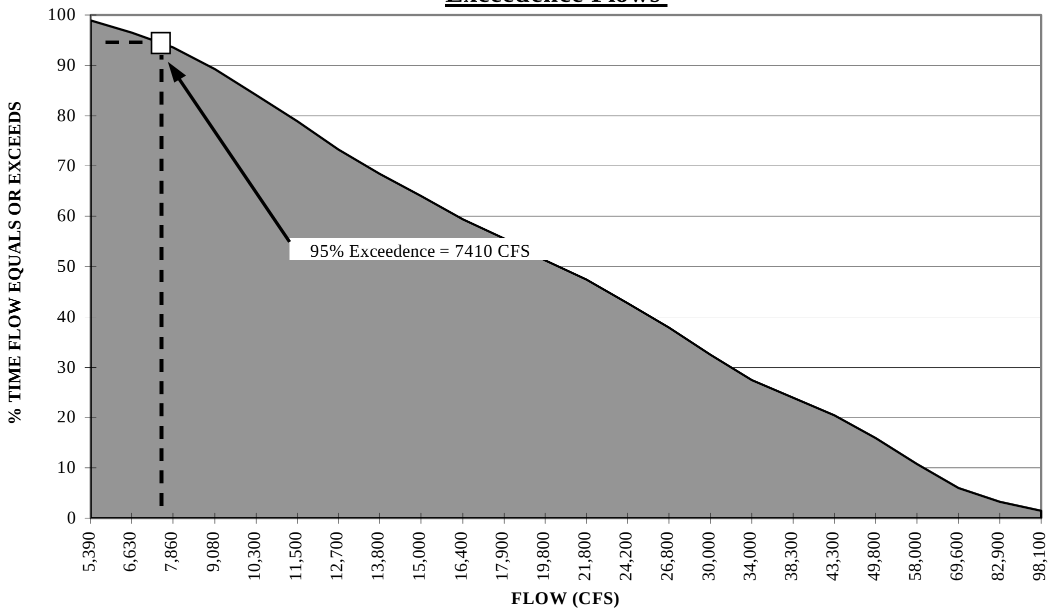
WHITE RIVER -DES ARC, AR
PERIOD OF RECORD (1965-1992)
Exceedence Flows



WHITE RIVER -DEVALLS BLUFF, AR

Exceedence flow developed from Newport and Clarendon data.

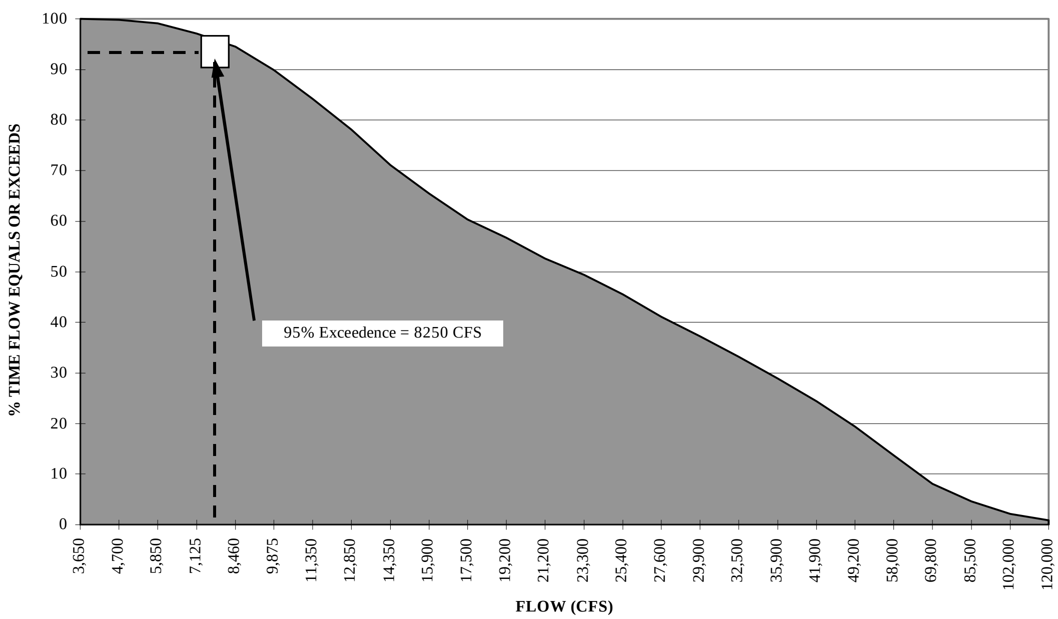
Exceedence Flows

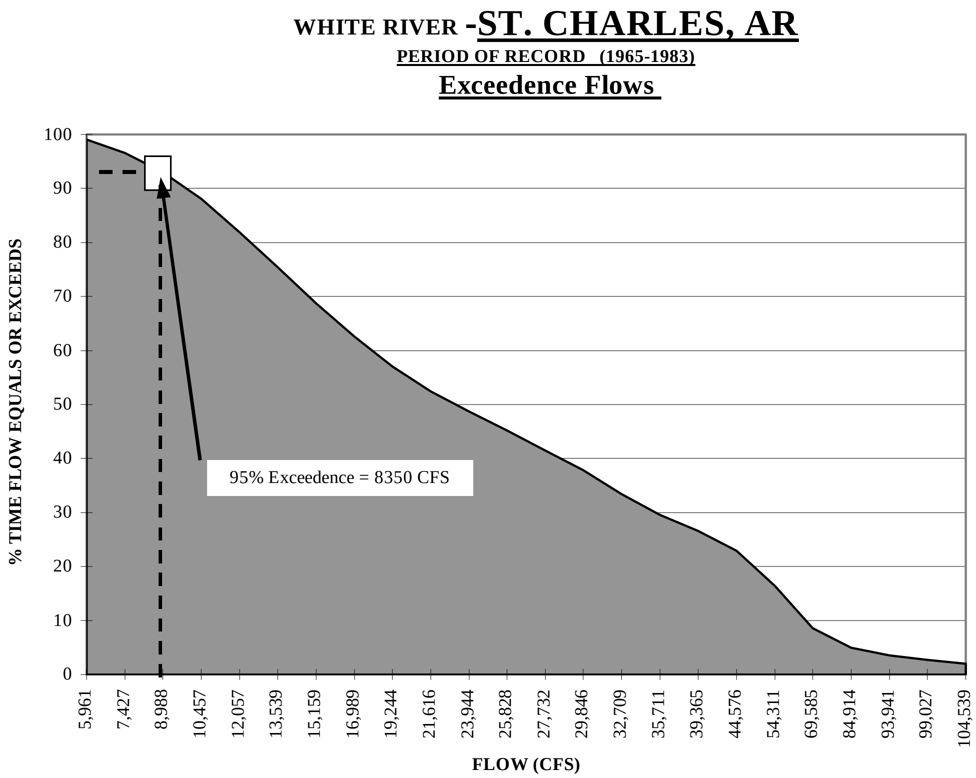


WHITE RIVER -CLARENDON, AR

PERIOD OF RECORD (1965-1992)

Exceedence Flows




WHITE RIVER -ST. CHARLES, AR
PERIOD OF RECORD (1965-1983)
Exceedence Flows
% TIME FLOW EQUALS OR EXCEEDS
0
10
20
30
40
50
60
70
80
90
100
95% Exceedence = 8350 CFS
5,961
7,427
8,988
10,457
12,057
13,539
15,159
16,989
19,244
21,616
23,944
25,828
27,732
29,846
32,709
35,711
39,365
44,576
54,311
69,585
84,914
93,941
99,027
104,539
FLOW (CFS)

WHITE RIVER, ARKANSAS (Below Batesville)

Total Tonnage (1982-1993)

(Short Tons- 2,000 lbs. per ton)

SHIPMENTS

Month	1982	1983	1984	1985	1986	1987
January	55,271	93,274	104,302	86,661	86,553	0
February	128,673	72,380	73,618	127,334	39,571	52,653
March	60,940	58,635	34,514	56,267	41,237	119,703
April	47,780	34,465	18,291	25,773	8,526	27,135
May	6,084	12,642	7,228	30,435	7,592	15,237
June	88,791	56,662	114,201	50,174	78,794	32,149
July	32,055	34,387	28,412	13,154	62,065	17,444
August	1,427	1,280	3,149	14,044	14,868	11,058
September	0	0	13,121	21,725	2,909	0
October	0	0	30,702	19,526	0	3,825
November	10,892	4,702	56,596	21,800	7,890	10,304
December	50,920	64,087	42,896	56,677	33,438	21,468
TOTAL	482,833	432,514	527,030	533,570	383,463	310,976

Month	1988	1989	1990	1991	1992	1993
January	96,595	104,217	0	50,786	82,278	129,471
February	112,259	78,549	130,064	107,034	57,815	109,113
March	51,335	74,209	151,089	124,842	56,435	67,990
April	22,672	42,245	52,393	20,309	18,771	9,595
May	13,802	7,208	14,983	8,253	11,755	11,179
June	4,843	20,335	53,159	9,765	57,144	52,534
July	7,055	42,356	30,314	41,517	111,959	58,890
August	9,044	4,724	5,266	4,180	21,969	1,407
September	0	0	12,546	0	0	0
October	2,344	0	11,824	0	0	14,754
November	20,086	0	3,595	25,939	0	58,963
December	94,066	0	27,985	55,978	30,188	59,906
TOTAL	434,099	373,843	493,218	448,603	448,314	573,802

Tonnage shipped per month by year from 1982 to 1993. Shipments are commodities leaving White River system ports. Table was compiled from Department of Water-Borne Commerce data.

WHITE RIVER,ARKANSAS (Below Batesville)

Total Tonnage (1982-1993)

(Short Tons- 2,000 lbs. per ton)

RECEIPTS

Month	1982	1983	1984	1985	1986	1987
January	3,364	4,323	28,244	1,402	7,266	2,788
February	10,890	4,245	26,304	0	5,786	2,713
March	5,523	5,501	12,894	5,751	17,710	10,848
April	4,169	4,349	9,873	12,015	7,061	7,414
May	2,698	4,303	8,674	8,518	10,990	4,104
June	15,134	6,920	8,258	10,556	13,580	2,832
July	2,729	4,853	3,363	4,433	3,982	1,953
August	0	3,655	1,385	2,782	2,343	0
September	1,419	1,205	0	0	1,203	0
October	1,456	0	5,260	7,029	0	0
November	0	0	2,832	2,841	2,961	0
December	7,188	4,271	5,608	5,730	13,604	3,100
TOTAL	54,570	43,625	112,665	61,057	86,486	35,752

Month	1988	1989	1990	1991	1992	1993
January	8,304	4,998	3,065	8,897	5,973	6,608
February	0	1,290	7,284	1,403	2,590	2,986
March	10,241	4,144	8,697	12,945	9,941	2,805
April	7,150	5,768	0	10,088	12,013	5,796
May	0	21,329	2,893	11,012	5,257	8,531
June	2,989	30,826	10,560	21,162	10,191	50,027
July	0	28,190	6,000	17,850	6,277	10,132
August	1,367	9,448	6,056	20,643	0	3,887
September	0	0	1,402	14,667	0	0
October	0	959	1,406	11,197	0	0
November	5,316	850	0	3,981	1,429	2,839
December	1,402	0	3,968	3,957	7,670	5,579
TOTAL	36,769	107,802	51,331	137,802	61,341	99,190

Receipts are shipments brought into the White River industrial area ports. Tonnage shipped per month by year from 1982-1993.

WHITE RIVER, ARKANSAS (Below Batesville)
Total Tonnage (1982-1993)
(Short Tons- 2,000 lbs. per ton)

THROUGH

Month	1982	1983	1984	1985	1986	1987
January	8,275		3,450	1,267	10,500	4,850
February	250		16,425			9,050
March	9,225		5,350		8,920	7,925
April	31,025				12,500	1,850
May	33,293					9,000
June	34,050		1,574			14,539
July	6,300	6,950	1,493	7,900	2,223	13,500
August		16,563		11,925		8,000
September		14,993		18,800		11,200
October				10,800		2,550
November		1,600		6,729		
December		3,555		625		
TOTAL	122,418	43,661	28,292	58,046	34,143	89,464

Month	1988	1989	1990	1991	1992	1993
January		2,252				
February	3,875					
March	6,750					
April	11,500					
May	10,700			4,400		
June				4,100		
July				5,760		
August		529	1,100			
September						
October						
November						
December						
TOTAL	32,825	2,781	1,100	14,260	0	0

Through traffic is defined as shipments whose destination and origin ports are on the White River. Tonnage shipped per month by year from 1982-1993.